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AMERICAN MACHINIST

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WAR BONDS
AND STAMPS
FOR VICTORY

Hitting a "Speck" 5 Miles Up . . .

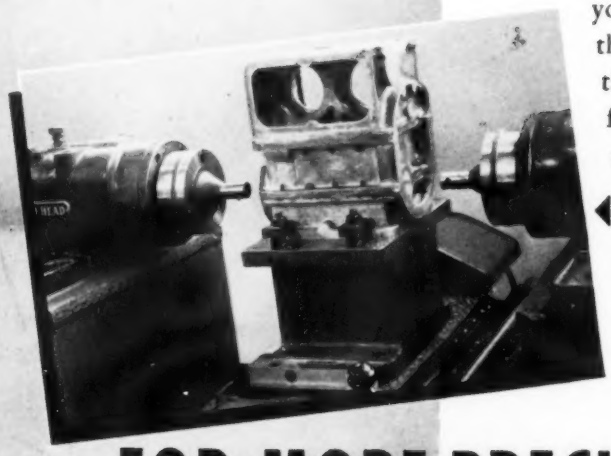
THAT'S PRECISION

As enemy aircraft approach and the ack, ack opens up, a tiny flaw in any mechanism might mean "target missed."

By *borizing* many important gun components to extremely close tolerances—often to .0002"—Heald Bore-Matics help put precision in anti-aircraft guns that gets specks 5 miles up. And because *borizing* assures constant duplication of accuracy, part after part matches identically.

It's no secret how Heald Bore-Matics get their extreme accuracy. It's simply the same Heald know-how in precision engineering that has made Heald Boring Machines and Heald Grinding Machines the answer in leading industries demanding close tolerances, high-speed production and cost reduction.

Heald Engineers are always ready to help you with your precision boring and grinding jobs. Ask for their services. They'll help you step up production through specially designed tooling and fixtures . . . specially designed for your Heald and for your own particular requirements.



Borizing a casing for Bofors 50 mm anti-aircraft guns. First operation bores two 3.375" diameter holes spaced 4.125" apart using a cross slide of indexing. Then work is indexed 90° and two holes 1.500" are bored in line by means of opposed heads.

The HEALD MACHINE CO.
WORCESTER, MASS. U.S.A.

FOR MORE PRECISION *FASTER*

BRING YOUR PROBLEMS TO HEALD

AMERICAN MACHINIST

June 24, 1943

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MAJOR ARTICLES

Powder Metals Find Wide Use 83
Simplified Grinder Aids Production ..... *S. L. Huffman* 87
Shotblasting Aircraft Engine Parts 88
Metal Washing Machines ..... *Dr. R. W. Mitchell & M. T. Zinty* 90
Machines Raised to Match Men ..... *Irl C. Martin* 93
Final Assembly of the Coronado 94
Concave Surfaces Can Be Milled ..... *Charles Havranek* 97
A Tailored Training Program ..... *B. H. Saltzer* 98
Cage Chutes for Drawn Parts ..... *Robert I. Miner* 100
War-Winning Suggestions 103

ARMAMENT SECTION

Wood Models Speed Plane Production ..... *Edmond J. James* 109
Armor Plate Milling ..... *Karl B. Kaiser* 116

SHORT ARTICLES

Hand Stoning Tools 97
Soap Serves the Shop 102
Recovery of Paint Overspray ..... *S. Donald Perlman* 148

IDEAS FROM PRACTICAL MEN

Ball Turning on a Lathe ..... *Fred J. Atzrott* 106
Long Work Aligned With an Indicator ..... *Ralph R. Waech* 106
Minimize Backlash in Leadscrews ..... *Orville E. Hyler* 107
Tool Drills Angular Holes 107
Tack and Plug Welding Simplified ..... *Oscar Craft* 108
Self-Locking Terminal Assembly ..... *T. C. DuMond* 108

NEWS OF THE INDUSTRY

Gaging Business 124b
Inside Detroit 124e
Wartime Washington 124g
Spotting the Air News 124i
Names in the News 124k
Obituaries 124l

DEPARTMENTS

Reference Book Sheet 121
Editorial 124a
Shop Equipment News 125
Trade Publications 140

AMERICAN MACHINIST *chips*

Praise the Poem and Pass the Reprints . . . Thanks to all you gents who have added a kind word to your requests for reprints of the poem "Question for Americans" by R. L. Nicholson. (Reproduced on this page, May 27 issue). We have passed on your comments to the author . . . the one who deserves them.

Further correspondence with Mr. Nicholson reveals that some 75 firms, plants, government agencies, Army and Navy Stations and newspapers have reproduced his message in various forms; it has even been broadcast. Mr. N. states that he has granted (at no charge) permission for its use where it was not identified with a firm or product in which any benefit would accrue to the user. It occurs to us that some of you may want to print it in company bulletins or house magazines. If so, you can get in touch with Mr. Nicholson at Wolf Creek Ordnance Plant, Milan, Tenn.

Meanwhile, we still have a few reprints of the poem left, offered *gratis* upon request in quantities up to 25. Want some?

o

Blueplate Blues. . . *The ingenuity of restaurateurs in dishing out tasty substitutes for good red beef continues to amaze us. But one place has gone a bit too far. Specializing in he-man food, they popped out the other day with a blueplate of "Extra Special Heavy Sour Cream with Cottage Cheese and Chives." Metal-Working plant cafeterias please do* not *copy . . . you'd probably have a workers' riot on your hands.*

o

Orchids to Axelson . . . We recently kibitzed on a letter from George V. Rickel of Auto-Ordnance Corp., Bridgeport, to Axelson Mfg. Co., whose lathe advertising appears in this journal. Subject was an Axelson ad (*page 184, April 29 issue of AM*) on the subject of absenteeism. Wrote Mr. Rickel, in part, "War posters have become my specialty; it was not until I read your ad that I finally found the best and I mean the *very* best. I took the liberty of placing it on the company's bulletin board. To my mind, it is just as forceful as a bombing raid except for the fact that it has not been brought before the entire public."

It's quite a stopper all right, Mr. Rickel . . . and we hope we'll never have to actually compare its forcefulness first-hand with that of a bombing raid.

o

Renegotiation Reverberations . . . It has been several months now since AM's Burnham Finney editorially harpooned a few half-truths about the touchy subject of renegotiation and pointed out some of the weaknesses therein. Yet comments from readers are still coming in . . . of which these are typical:

"Having since that date (April 1) completed our own renegotiations, we heartily agree with everything you say. Keep up the good work!"

"I am immediately sending copies with letter to our Senators . . . also our Representative."

". . . so good I want to recommend that a copy be sent to every Congressman and Senator in Washington, and perhaps to every official of a renegotiation board in the United States. It must be brought home to these people about the seriousness of industry." (Ed. Note —This was done.)

". . . summarizes very well the difficulties we have experienced with this procedure . . . Judging from the data that has been collected by the Truman Committee, renegotiation of 1942 business will be completed in about 100 years."

o

Straw Lids . . . We all have our troubles, but shed a small tear for the straw hat manufacturers. Harassed by a rainy, cold spring, they can't get going on promotion. Moreover, governmental censorship of weather forecasts (according to *Advertising Age*) has hit the hat industry a severe blow, since all the weatherman can tell them is that 24 or 48 hours hence there most certainly will be weather—whether good, bad or indifferent, but in any case a strict "military secret."

Well, everybody who is anybody always knows it's the Weatherman's fault when we have bad weather . . . but this is one case where our favorite scapegoat can't be blamed.

As a personal note, we sallied forth with our two-year-old straw immediately following Decoration Day, according to custom, and promptly got it soaked in a downpour. Best way in the world to bring on rain . . . better, even, than washing the car or forgetting your umbrella.

o

Septuagenarian . . . One reason the Axis under-estimated America's power to produce was that they didn't know we had men with the spirit shown by Lewis W. Spaulding of Vancouver, Washington. Writes this stalwart veteran: ". . . I am now past 78 years of age and have been working as a machinist and as a Defense Training Instructor since last July 23 and believe I am doing a good job. During this time I have voluntarily laid off only a day and a half."

"A Real Old Timer," he signs himself . . . and a real American too, we'd like to add. Nice going, Mr. Spaulding.

Do we have any readers active in Metal-Working who can top Mr. Spaulding's 78 years? Let's hear from some of you young oldsters.

o

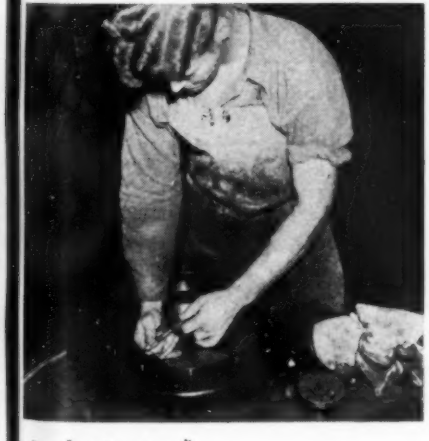
"Tools" No. 3 . . . *In the May 27 issue of AM appeared the latest in the series "The Tools of Our Trade." This time it's "How to Run a Milling Machine" . . . presenting basic information for the new worker coming to the shop from non-industrial work or being up-graded from some simpler shop operation. This is proving a welcome addition to the training material now being used so extensively by Metal-Working executives; requests for reprints of the first two sections (on simple shop tools and drilling technique) are already crowding the 30,000 mark.*

Reprints of "How to Run a Milling Machine" are now available on the same basis as the others: Less than 10 copies free, over that 10¢ per copy with a slight reduction for lots over 500.

AVOID DISTORTION WHEN YOU QUENCH

MANY precision parts must be quenched to obtain necessary strength and hardness. An uncontrolled quench, however, results in distortion, which either destroys previously machined accuracy, or necessitates leaving excessive stock to be removed after hardening.

Gleason quenching presses eliminate both of these undesirable conditions by providing a *controlled* quench which holds distortion to a minimum. The principle is simple—the work is held between dies and aligned while still plastic. It is then submerged, and the dies allow normal contraction, while directing the flow of quenching oil so that an absolutely uniform quench is obtained. The rate of quench may be regulated as desired, down to a few seconds per part. An automatic timer returns the work to loading position, assuring uniform length of quench for all parts.—All the operator does is to load the press and push the button.



Manufacturers are finding Gleason presses ideal for a variety of work—gears, discs, lines, bearing cups and cones, —even such parts as crankshafts and breech blocks.

The presses are made in two sizes, 15″ and 25″, for parts up to these respective diameters. The 25″ press can be supplied with a roller fixture attachment for quenching shafts and integral shaft pinions up to 22″ length.

Let us show you how a Gleason quenching press can solve your quenching distortion problems. Write for information or, better yet, send prints of the parts you want to quench.

GLEASON

GLEASON WORKS

Builders of Bevel Gear Machinery for Over Seventy-five Years

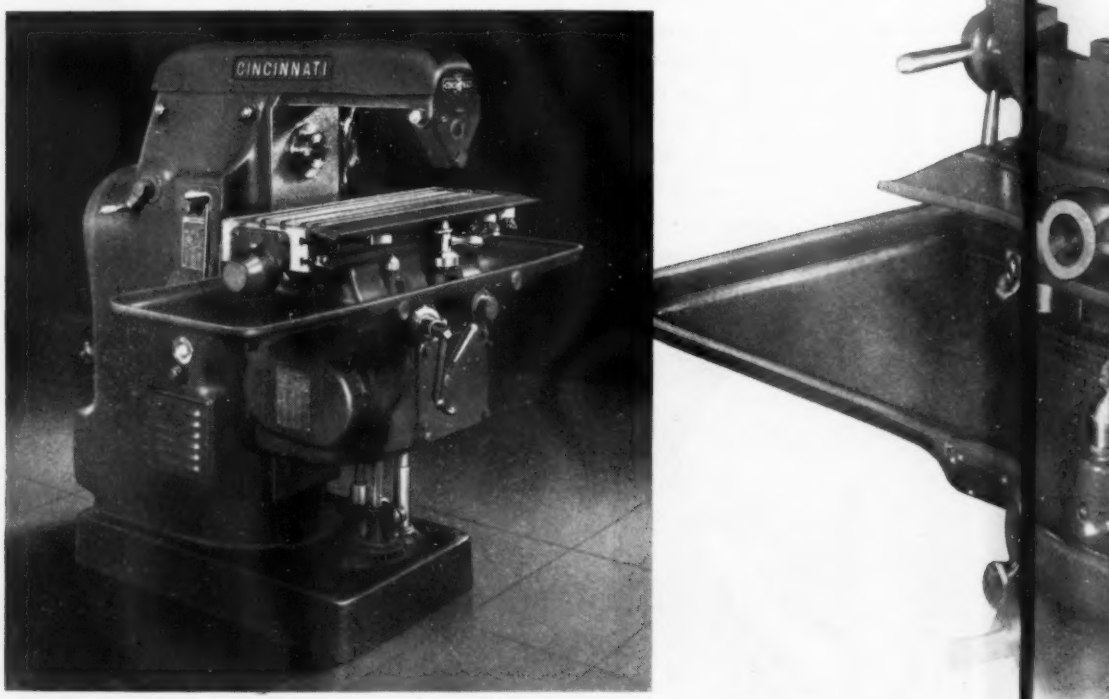
1000 UNIVERSITY AVENUE, ROCHESTER, N. Y., U. S. A.

ARMY E NAVY

Another Example of **CINCINNATI M**

on the **PRODUCTION FRON**

By adding a second fixture to CINCINNATI 1-18 Plain Automatic Milling Machines, production of connecting rods for aircraft engines was practically doubled. One part is milled while the other is being loaded. There's no lost time. Cutting is virtually continuous. Here again the Cincinnati Engineers at Milling Headquarters have applied their knowledge in stepping up another milling operation on a part vital to the war effort. ¶ You'll be interested in all the details of the CINCINNATI 1-18 and its adaptability to the fast, accurate, economical production of countless small parts in any quantity. Look in Sweet's Catalog File for a brief description. Or write for specification folder M-848.



CINCINNATI 1-18 Plain Automatic Milling Machine. Folder M-848 gives complete details on all features.

Navy E awarded March 6, 1942. Renewal star awarded August 29, 1942, along with Army-Navy E. The second star was awarded Feb. 23, 1943.

THE CINCINNATI MI

MILLING MACHINES

BR

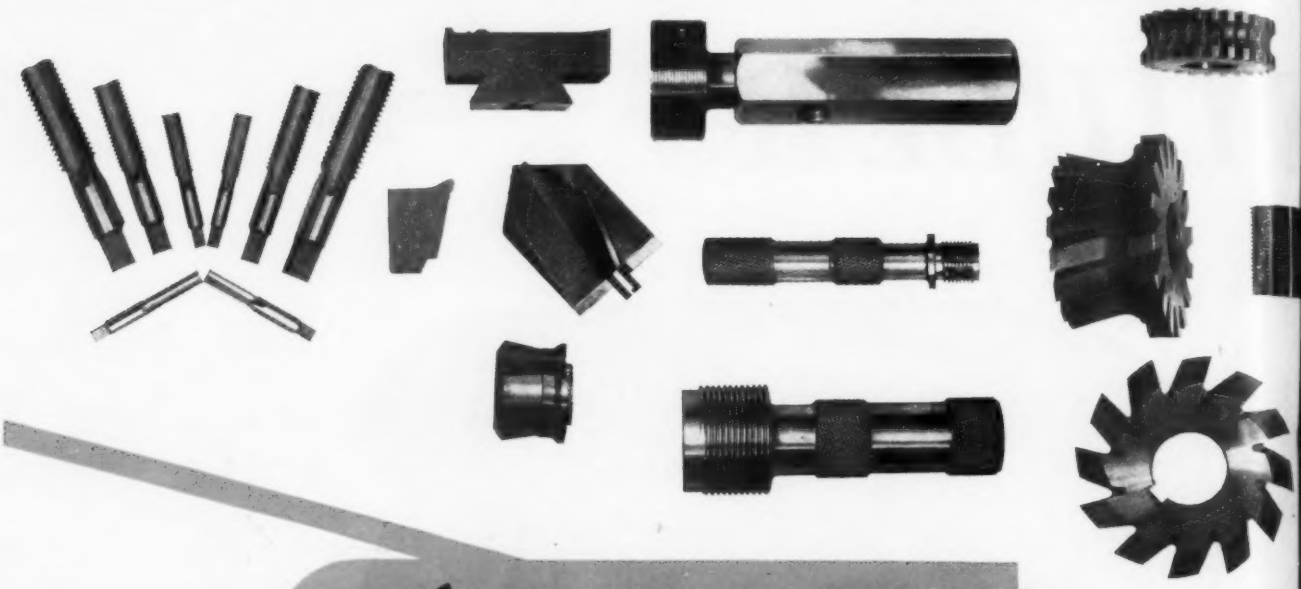
MILLERS

CINCINNATI

Illustrated is the CINCINNATI 1-18, equipped with two work fixtures, milling the sides of bosses on connecting rods.

MILLING MACHINE CO. CINCINNATI, OHIO, U. S. A.

BROACHING MACHINES • GRINDING MACHINES • LAPPING MACHINES

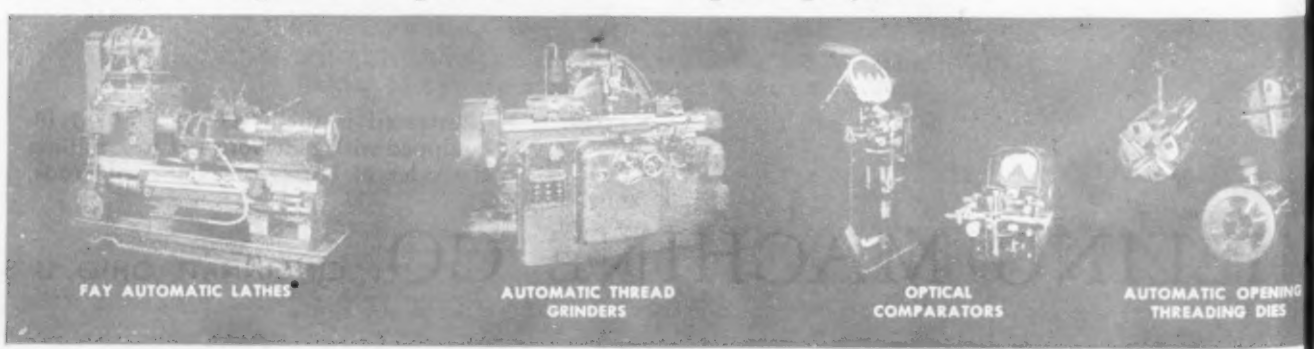


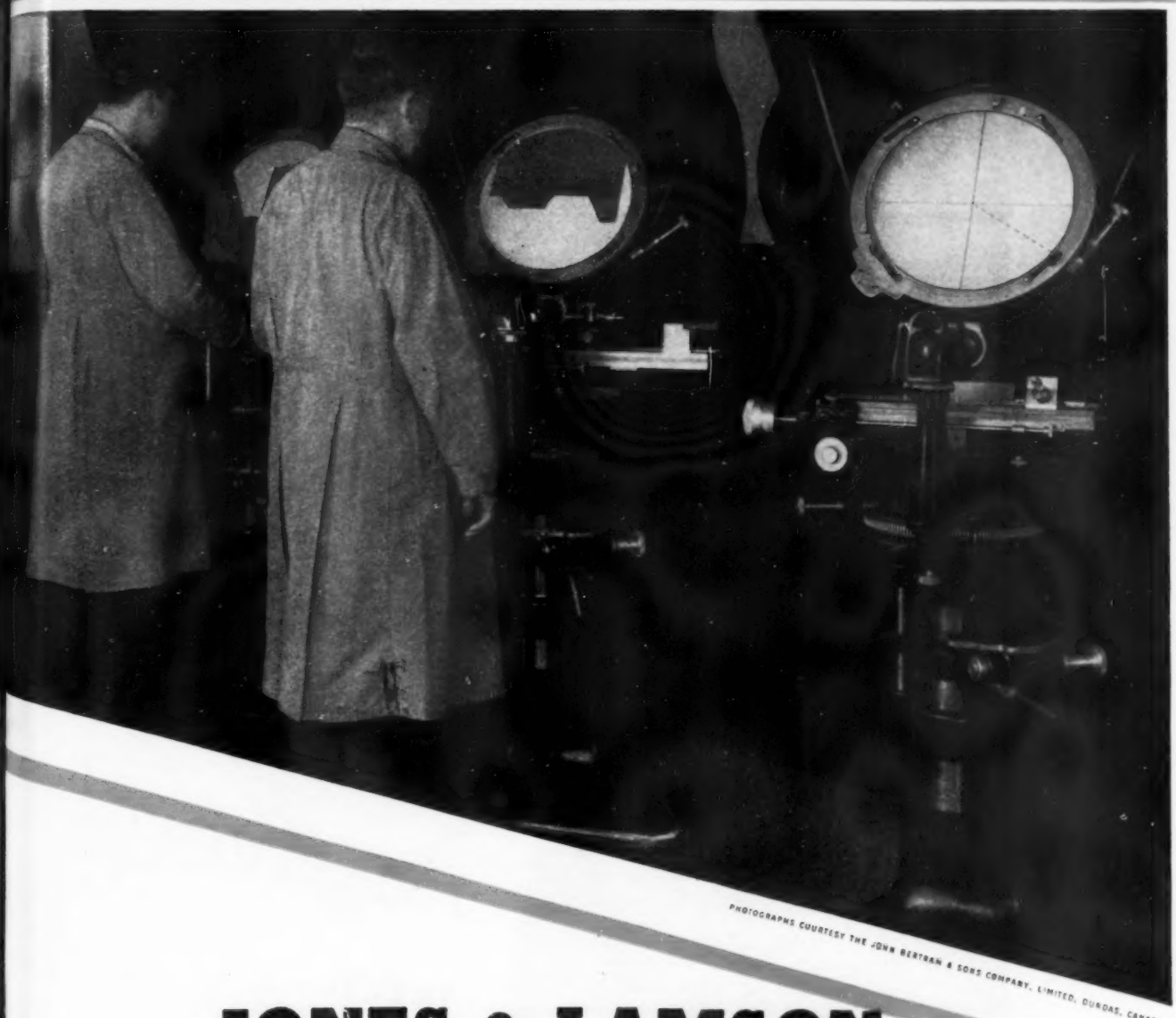
Accurate RAPID INSPECTION OF TOOLS AND GAGES

Jones & Lamson Optical Comparators assure accurate, rapid inspection of tools and gages in the Pratt & Whitney Plant of John Bertram & Sons Co., Dundas, Canada.

The use of these **Comparators** by progressive manufacturers everywhere, has resulted in better tools and gages, increased efficiency in inspection departments and substantial savings in materials and costs.

Various models are available to cover an almost unlimited range of inspection work, and our inspection engineers are ready to study your problems and make recommendations based upon more than twenty years' experience in the field of inspection by optical projection.





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JONES & LAMSON
MACHINE COMPANY

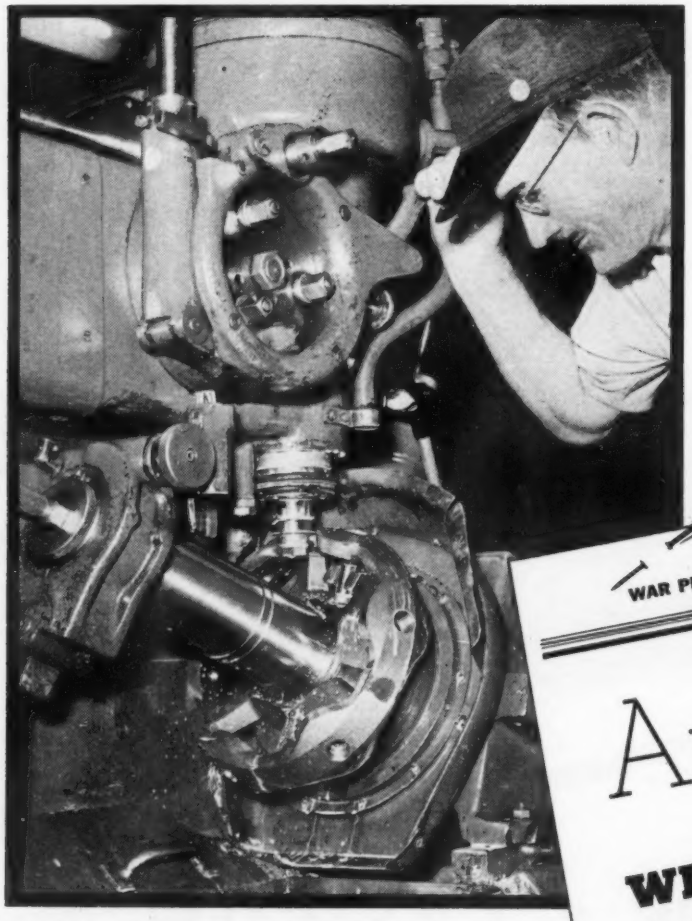
Springfield, **Vermont, U. S. A.**

Manufacturers of: Universal Turret Lathes · Fay Automatic Lathes · Automatic Thread Grinders · Optical Comparators · Automatic Opening Threading Dies.

SADDLE TYPE
UNIVERSAL TURRET LATHES

PROFIT-PRODUCING
MACHINE TOOLS

RAM TYPE
UNIVERSAL TURRET LATHES



By using special Fellows 7A-type Gear Shapers, which hold the work at an angle, the irregular contour on both sides of the rim of this propeller shaft are rapidly and accurately machined.

Problem: ow

"DIS INIS

WAR PRODUCTION BULLETIN

Answer:

WITH SPECIAL FELLOWS GEAR SHAPERS

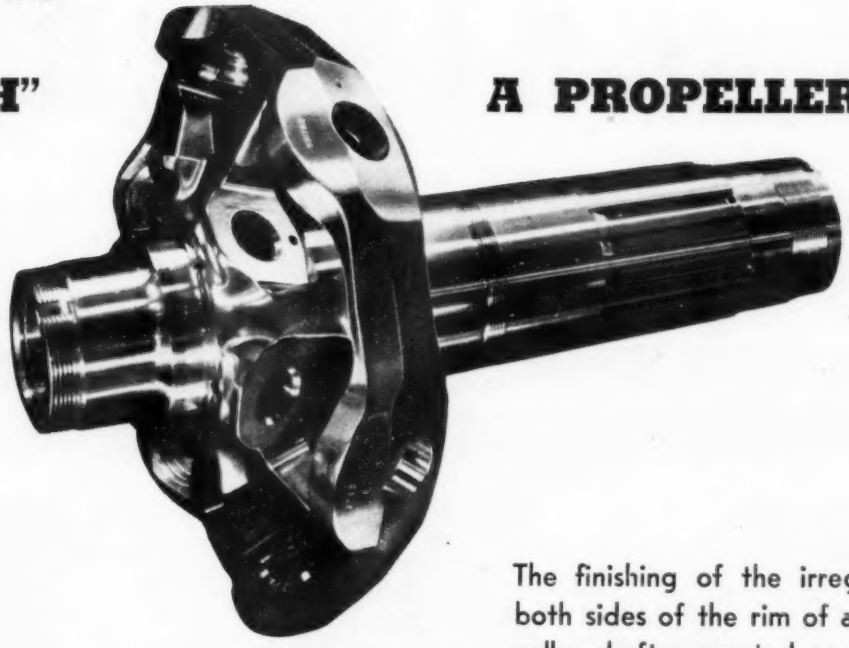
FELLOWS

MACHINES AND TOOLS FOR GEAR PRODUCTI

OW TO

INISH"

A PROPELLER SHAFT RIM



The finishing of the irregular contour on both sides of the rim of an aeroplane propeller shaft presented an interesting problem which was satisfactorily solved by the Gear Shaper Method. The machining of both sides of this rim is handled on special 7A-type Gear Shapers, which hold the work at an angle. Machining is done with a plain disk cutter—without teeth—the operation of which is controlled by a special feed cam to produce the required contour. This is another interesting example of the versatility of the Gear Shaper method. It not only produced a finish, which reduced final polishing to the minimum, but also reduced costs.

Our general catalogue, "The Fellows Method", presents many other interesting examples. For your copy, write: The Fellows Gear Shaper Company, Springfield, Vermont — or 616 Fisher Building, Detroit, Michigan, or 640 West Town Office Building, Chicago, Illinois.

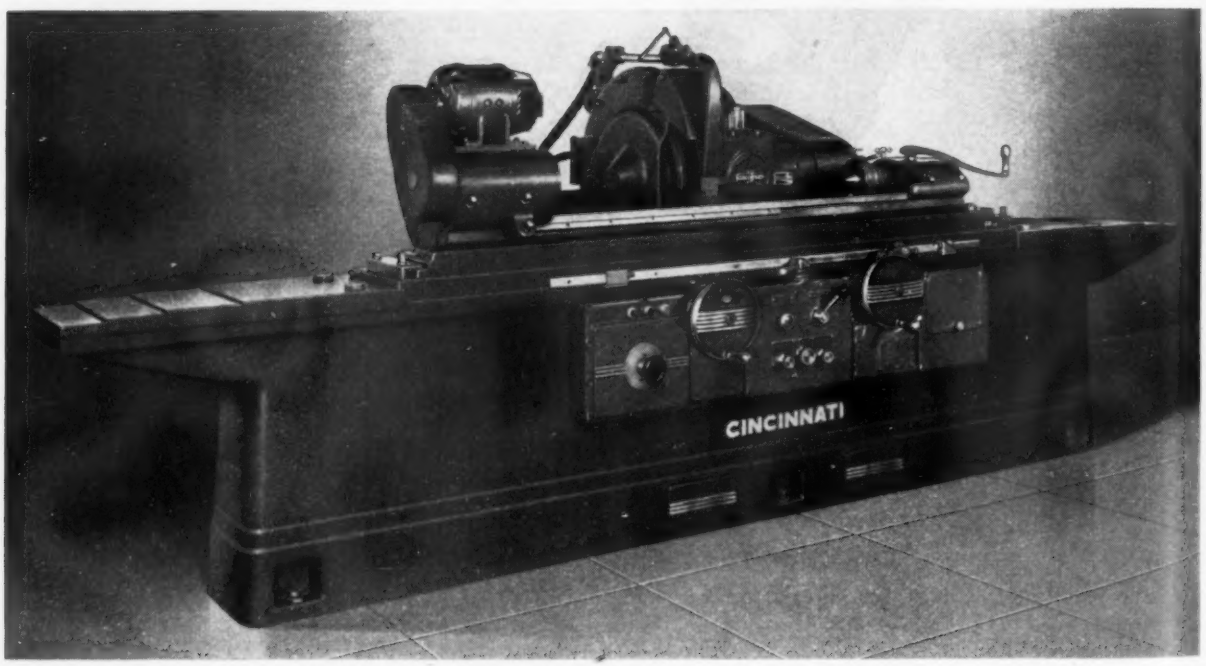
Method

. . . . FROM BLANK TO FINISHED GEAR

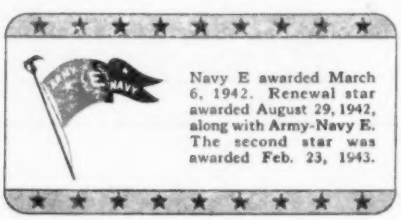
Another Example of

CINCINNATI GRINDERS

on the PRODUCTIO



CINCINNATI 10" Plain Hydraulic Grinding Machine. Specification catalog G-490 gives complete details on all features and benefits.



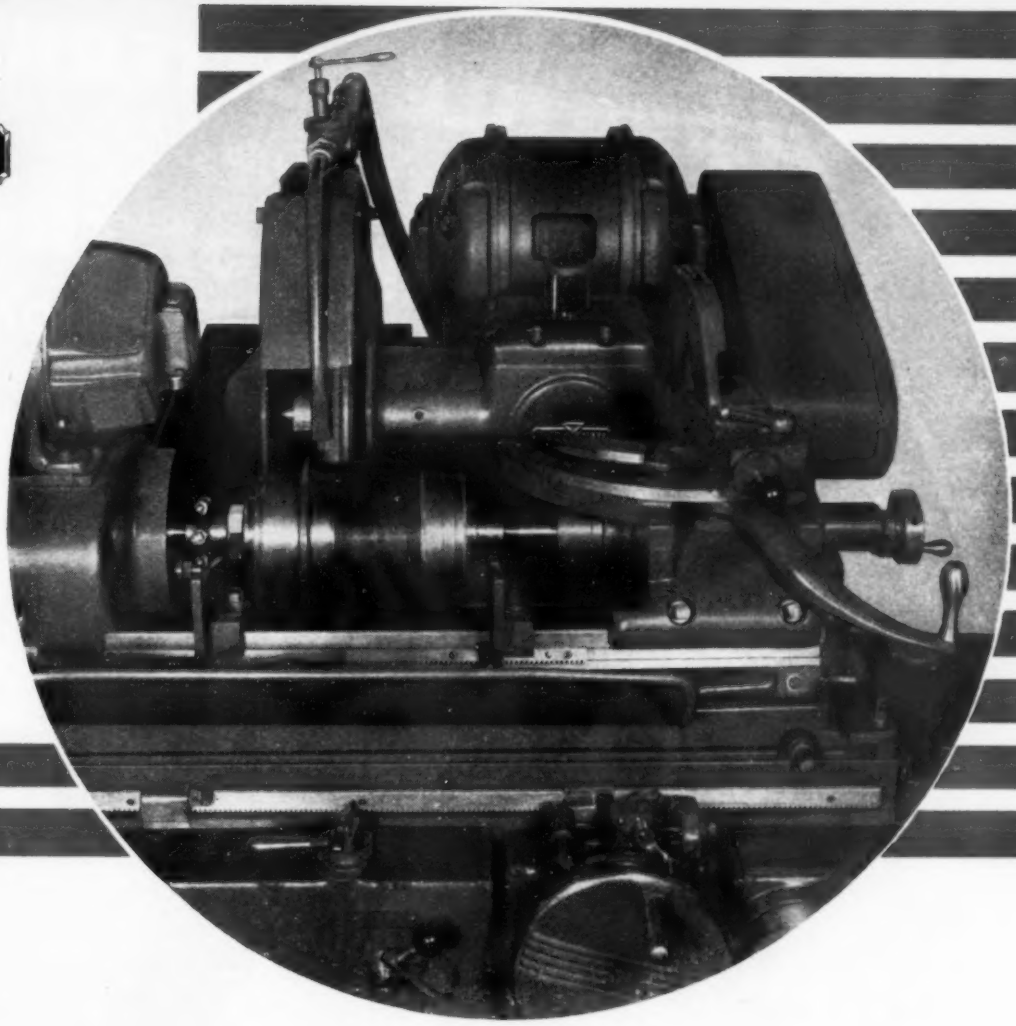
Navy E awarded March 6, 1942. Renewal star awarded August 29, 1942, along with Army-Navy E. The second star was awarded Feb. 23, 1943.

CINCINNATI GR

CENTER TYPE GRINDING MACHINES

CINCINNATI

FRONT



In the illustration above a CINCINNATI 10″ Plain Hydraulic is grinding the radius neck between the flange and fins of an aircraft cylinder barrel. The footstock incorporates a special truing device for truing the wheel to the correct profile. This is another typical example of how the engineers here at Grinding Headquarters are helping make possible undreamed of production records in industry. Through this adaptation, production was greatly increased over previous methods which were considered fast. ¶ The CINCINNATI 10″ Plain Hydraulic Grinding Machine is ideal for precision centertype work requiring a high degree of accuracy and finish. Also for parts that must be produced rapidly. You'll be interested in learing about its many unusual features. ¶ Investigate the possibilities of using the CINCINNATI 10″ Plain Hydraulic for your work. Sweet's Catalog File for Mechanical Industries will give you a brief description of this machine. Or for more detailed information send for specification catalog G-490. A copy is yours for the asking.

GRINDERS INCORPORATED

CINCINNATI, OHIO, U. S. A.

CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

VERSATILE CUTTERHEAD..

SAVES WORK RESET-UPS

SIMPLIFIED CONTROL..

PROVIDES EXTRA OPERATING CONVENIENCE

SPECIFICATIONS

No. 22L UNIVERSAL MILLER. Table: 45" x 10". 9 Speeds: 40 to 1100 r.p.m. 12 Feeds: 5" to 36". Cutterhead adjustable between vertical and horizontal: 90°

..on VAN NORMAN Universal Millers

The versatile cutterhead on Van Norman Ram Type Universal Millers gives you vertical, horizontal or angular milling by simply swinging the cutterhead to the desired milling position. Thus in one compact machine you have the range of several types of millers.

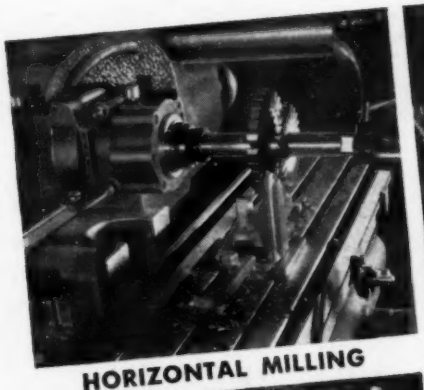
This Van Norman feature enables operators to complete most milling operations on a workpiece without resetting the work. In addition, there is no waiting for other types of millers to become available. The valuable time saved often increases the productive output of the machine and operator by as much as 50%. (note the typical milling applications shown below)

The adjustable cutterhead...combined with front and rear directional control of all power feeds for the table, knee, saddle, as well as 6-way rapid traverse... quick-change speed and feed selectors conveniently located for easy reach by the operator... and other important Van Norman Features which assure accuracy, economy and top production.

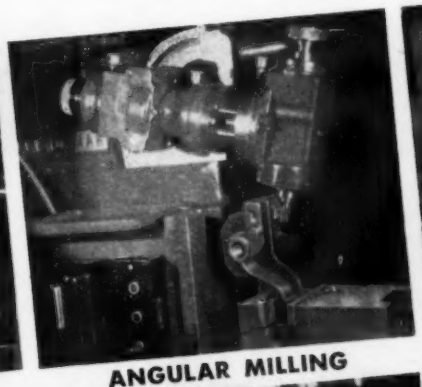
"It pays to Van Normanize"

VAN NORMAN MACHINE TOOL CO.

SPRINGFIELD, MASSACHUSETTS

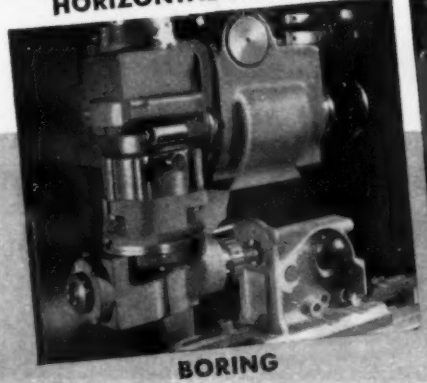


HORIZONTAL MILLING

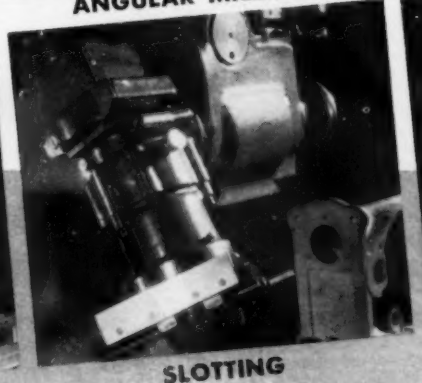


ANGULAR MILLING

VERTICAL MILLING



BORING



SLOTTING

ANGULAR MILLING with sub head

16 Vital

Single pulley drive and bearings · Gear disconnecting any opens and closes by inner walls · guides through felt giving fly-wheel ef-

LANDISize
Your Threads

The many new and exclusive features of LANDMACO Threading machines combine to assure the greatest possible degree of accuracy, ease of operation and flexibility in making set-up changes.

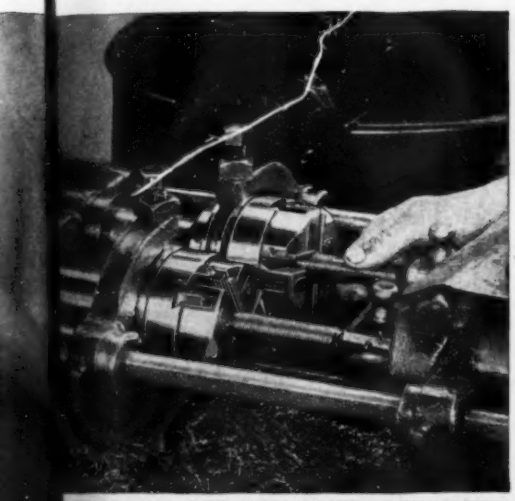
LANDIS

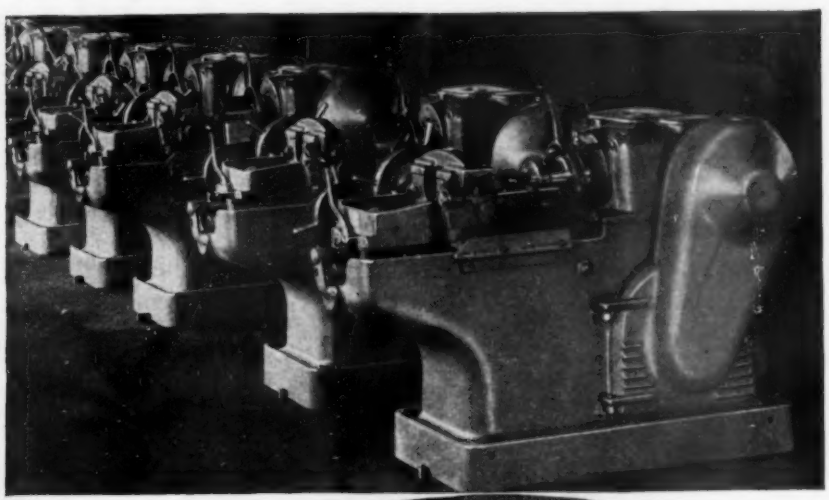
THREADING MACHINERY · THREAD CUTTING DIE HEADS

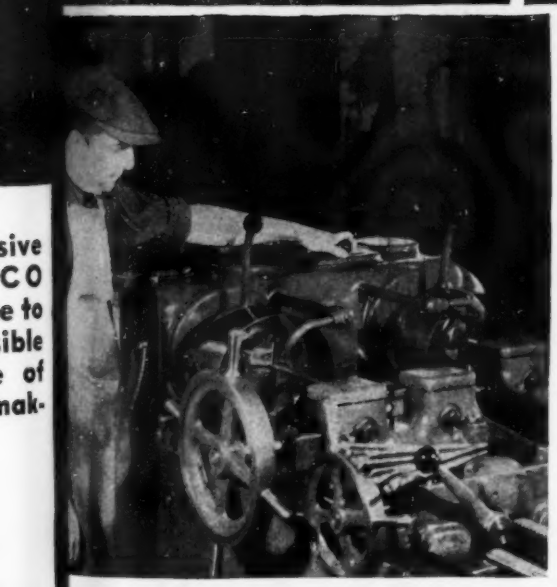
Reasons for the Superiority of

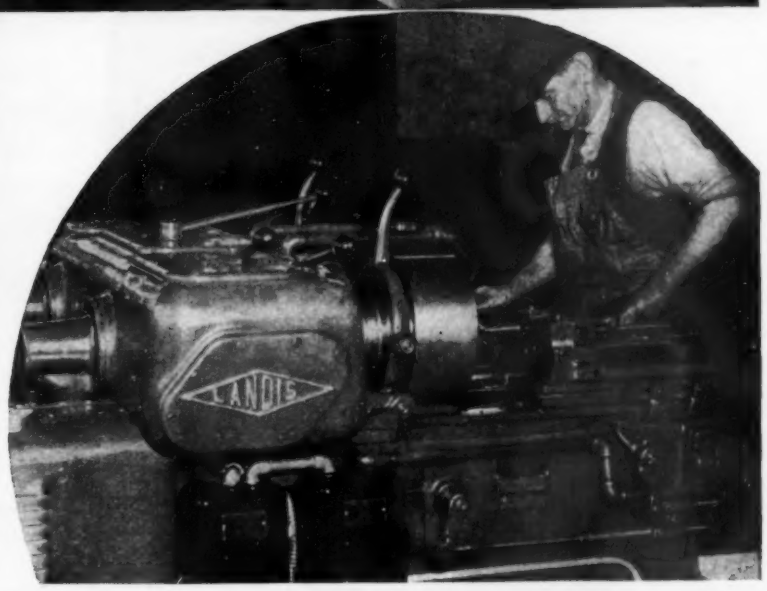
LANDMACO THREADING MACHINES

lf-contained selective type gear box provides eight spindle speeds · Flood lubrication for all gears
pe pump direct driven and automatically reversible · Built-in pump can be removed without
ping · Motor-in-base affords compact and efficient motor drive · Friction clutch control · Head
tomatically · Hand lever for opening and closing head · Semi-steel bed of box type reinforced
nimum die head overhang · Adjustable vise easily lined up with spindle · Oil reservoir lubricates
ds in carriage base · Gibbed carriage compensates for wear · The heavy rim of vise hand-wheel,
ct, facilitates gripping of work · Guards completely cover and protect guides









SMACHINE CO. WAYNESBORO PENNA. U.S.A.

COLLAPSIBLE TAPS · PIPE THREADING AND CUTTING MACHINES

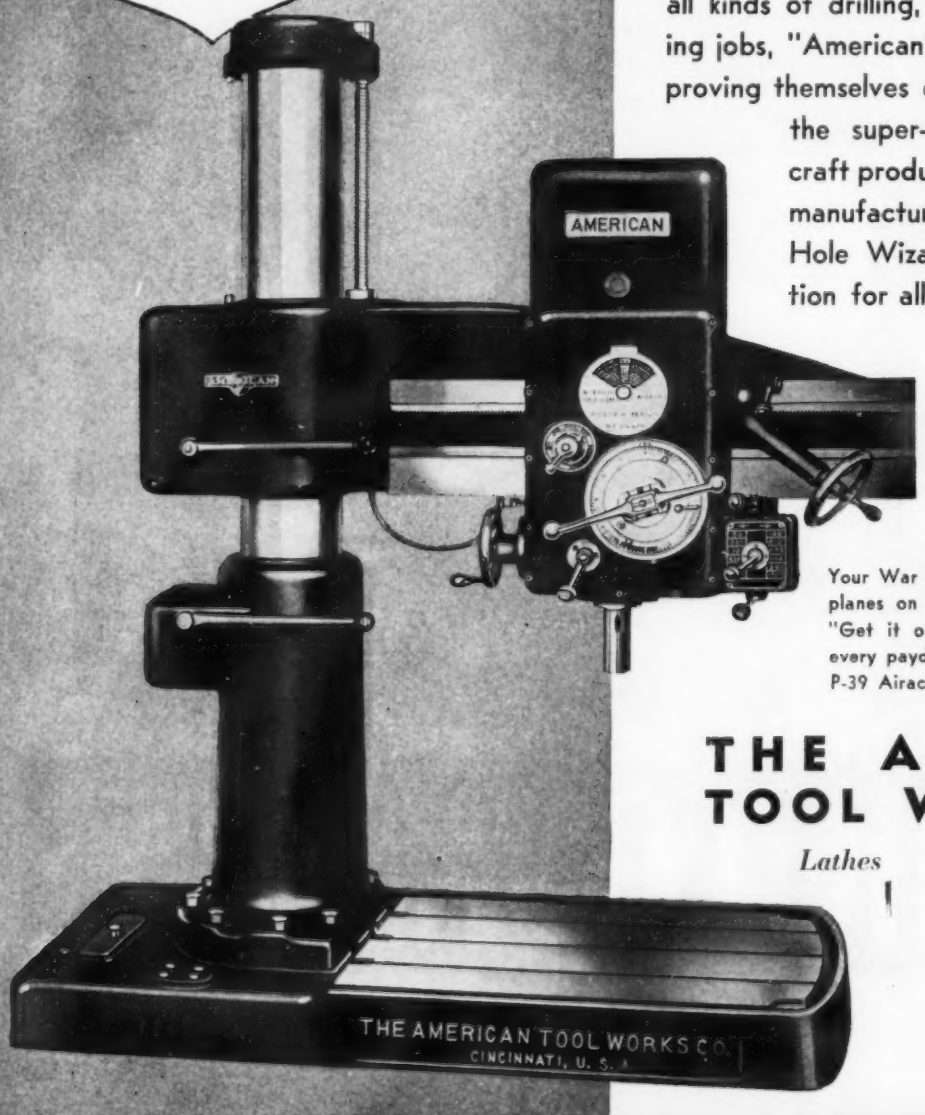
Photo Courtesy Bell Aircraft Corp.

"AMERICAN"
FOR
ALL-OUT
PRODUCTION

ARMY E NAVY

A WINNING COMBINATION

Increasing numbers of planes, lined up on every one of our far-flung airfields, testify to the success which American aircraft manufacturers are achieving. Helping them with all kinds of drilling, boring, facing and reaming jobs, "American" Hole Wizard Radials are proving themselves outstanding performers on the super-accurate jobs which aircraft production demands. American manufacturing skill, plus "American" Hole Wizards! A winning combination for all types of war production.

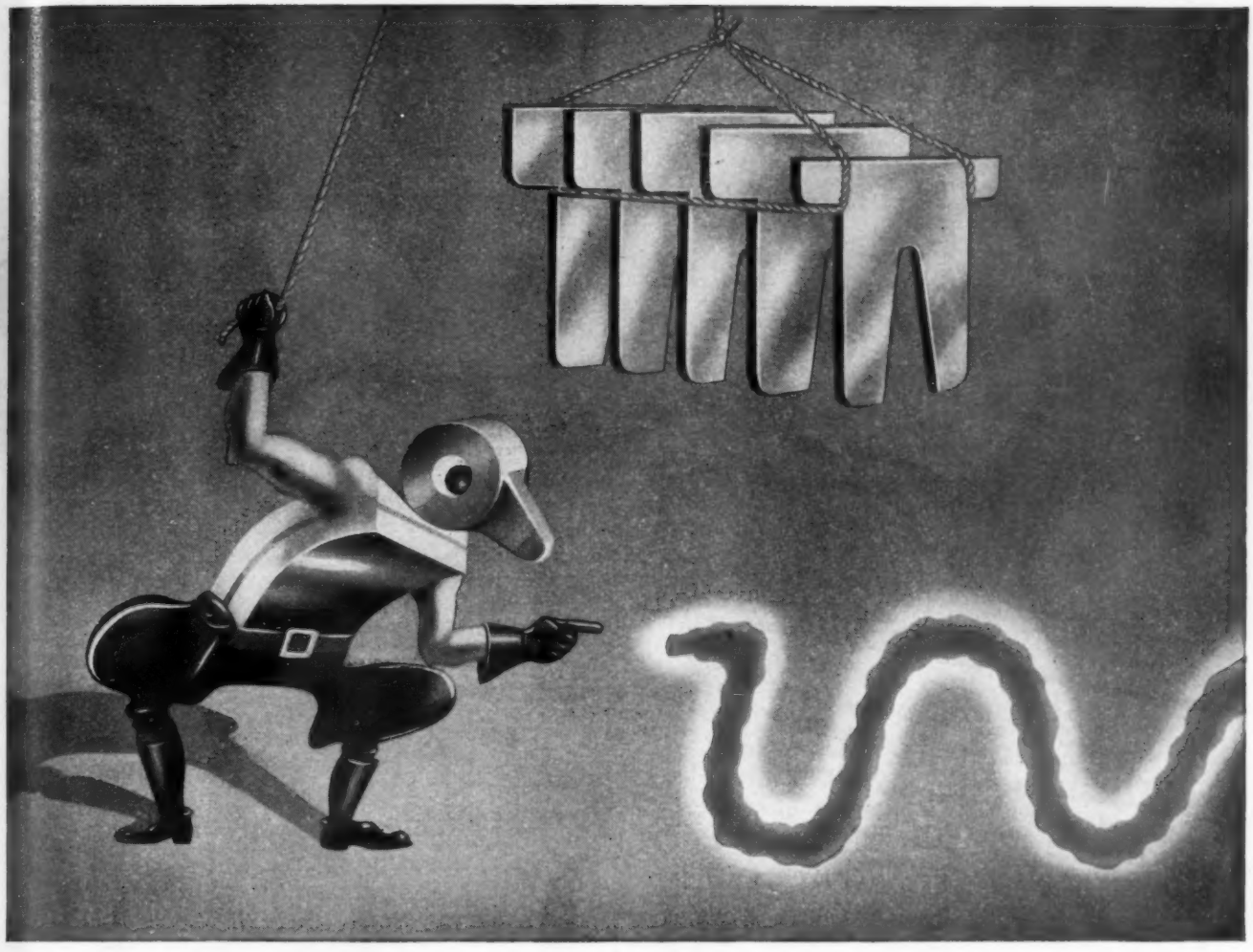


Your War Bonds and Stamps help to get these planes on the line in ever-increasing numbers. "Get it on the line" for Bonds and Stamps every payday and keep planes like these Army P-39 Airacobras flying!

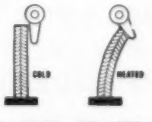
THE AMERICAN TOOL WORKS CO.

Lathes Radials Shapers

CINCINNATI
OHIO



"one false move and you're Dead!"



THIS IS THE BRAIN that tells whether an overload is dangerous or not. It's Westinghouse Bi-metal. Two different metals which react differently under heat are bonded together. Dangerous overloads cause this Bi-metal to bend, tripping the interrupting mechanism, opening the circuit.

THIS IS THE BRAWN that quenches the arc. Made up of parallel metal plates in the form of a grid, it draws the arc into the chamber, divides it into segments and smothers it between the plates . . . it all happens in the space of half a cycle!

Current that gets out of hand and threatens equipment or power circuits gets short shrift when the circuit is protected by Westinghouse "De-ion" Circuit Breakers.

With uncanny accuracy, this "De-ion" protective device outguesses the current, beats dangerous disturbances to the punch. Momentary, harmless overloads are passed without interruption; but when the circuit is actually threatened, the sensitive Bi-metal element goes into action, *quick!* The circuit's broken, the arc quenched, in the space of a blink of an eye.

It protects itself, too. The fast action minimizes arc effects, lengthens contact life. Its factory-set calibration is not disturbed. And, when the interruption has been corrected, a simple flip of the indicating handle restores service in seconds. No time lost locating a busy maintenance man; no parts to repair or replace.

Protect equipment and electrical circuits with Westinghouse "De-ion" Circuit Breakers. Ratings to 600 amperes; enclosures for any type of service. Call Westinghouse today. Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N.

J-21267

WESTINGHOUSE

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

"DE-ION" CIRCUIT BREAKERS

IT'S ALL HERE

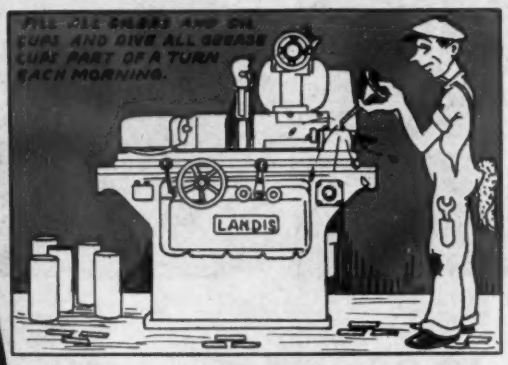
Chapter VIII

LUBRICATION

This modern mechanical civilization of ours literally travels on a film of oil. As might be expected, the close accuracy which it is necessary for a precision grinder to produce finds this same oil film playing its important part.

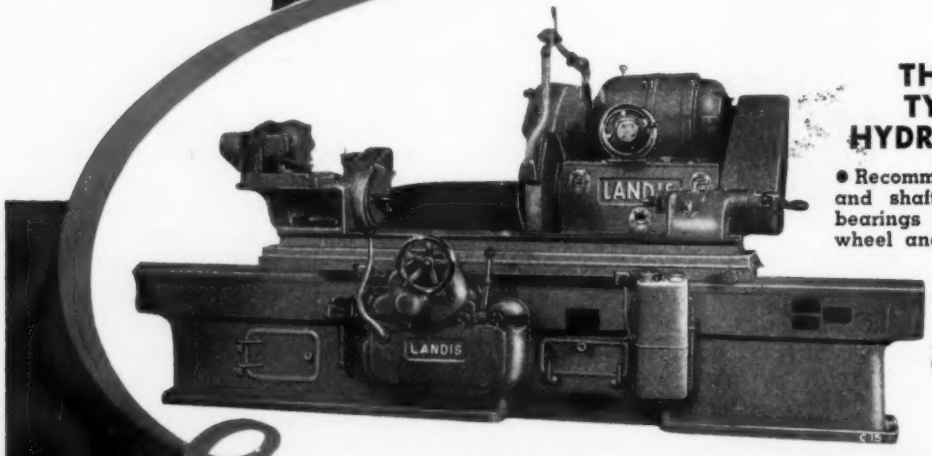
Consider for a moment the extreme lubrication requirements of a modern grinder. Wheel spindles operate at relatively high speeds and under extremely heavy loads, yet clearance between the spindle and bearings in some instances dare not exceed .0003" to .0004". Some high speed internal spindles operate as rapidly as 50,000 R.P.M. and under very heavy loads for their size. The maintaining of an adequate oil film is obviously important and not too easy. Guideways must be kept continuously lubricated but in such a manner that a varying oil film will not be introduced, which would make it difficult to maintain consistent accuracy.

These examples should suffice to show the importance of adequate and proper lubrication and the necessity of following the manufacturer's specifications if the best of results are to be secured.



There is no substitute for plenty of good clean oil and grease. Oilers and grease cups are provided so that the machine will give constant trouble-free operation. Use them.

More grinding machine failures are due to inadequate lubrication than most operators realize. A good rule to follow is to use too much rather than too little. You will be more likely to keep your grinder operating smoothly, however, if you study the eighth chapter of the book "Better Grinding." The mailing of the coupon below will bring you a copy. It's easy to read, informative and complete, as it includes seventeen other chapters on various aspects of the art of precision grinding.



THE LANDIS 10" TYPE DC PLAIN HYDRAULIC GRINDERS

- Recommended for general spindle and shaft work, for crankshaft line bearings and miscellaneous multiple wheel and form wheel grinding.
- Used by war industries for assorted crankshaft operations.
- Available in three lengths, namely 36", 48" and 72".

IF YOU HAVE A GRINDING PROBLEM

Let George do it

LANDIS TOOL COMPANY

George Grindit Says

"Deprive moving parts of a film of oil and they often screech in protest. Then they give up the ghost. Precious hours and material are lost. Oil right and your grinder will generally be "oil-right"."

The book "Better Grinding," procurable only from the Landis Tool Company, Waynesboro, Pennsylvania, pictures and describes the basic principles of all precision grinding. Thousands of both old and new operators, supervisors and apprentices are finding it helpful every day.

THE CHAPTERS

Work Centers and Centers in the Work . . Work Drivers and Driving Dogs . . Work Rests . . The Diamond . . Wheel Dressing and Wheel Truing . . Mounting and Balancing the Wheel . . Grinding Wheel Coolant . . Lubrication . . Multiple V Belt Drives . . Wheel Spindles and Bearings . . Grinding Wheel Feed . . Grinding Wheel Width . . Speed of Work Carriage Traversal . . Work Speed . . Grinding Wheel Speed . . The Grinding Wheel . . Chatter . . Miscellaneous Bits.

Please Send Me a Free Copy of . . .

"BETTER GRINDING"

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____ B

Please Print Above and Send To

LANDIS TOOL CO.

WAYNESBORO, PENNSYLVANIA

WAYNESBORO, PENNSYLVANIA

ABLE TO TAKE IT--

IN THE TOOL ROOM OR ON THE PRODUCTION LINE

Built to "dish it out" and take it, too, Uncle Sam's tanks demand tough materials and skilled design to give them stamina and striking power.

The same principles hold for milling machines —the machine tools that are mighty important in building tanks and other weapons. In tool room or on the production line, milling machines must be built to perform at a record-breaking pace and maintain close tolerance-accuracy in operation.

The center bearing on the spindle of Milwaukee Milling Machines reduces by one-half the distance between bearings—*increases rigidity eight times!*

Ask the man at the controls of a Milwaukee—he can tell you how important this center bearing is (in addition to the husky column) in providing built-in rigidity and all that it means in sustained accuracy — longer cutter life —smoother performance at all speeds and feeds.

KEARNEY & TRECKER
CORPORATION
MILWAUKEE, WISCONSIN

Buy Victory with at least 10% in War Bonds!

Milwaukee MACHINE TOOLS

"Breaks" LIKE THIS

ARE NO "BREAK" FOR PRODUCTION

Broken tools—mechanical troubles — caused by improper care and operation of machine tools, are no help in production for Victory. Practically every machine tool manufacturer offers valuable advisory service — "care and operation" handbooks — technical bulletins — on better methods of operation that help green men as well as speed and improve production of skilled workers.

Put full information in the hands of the men who operate your machine tools — teach them the "know how" to get the most in production with the least waste of time, effort and materials.

Buy Victory with at least 10% in War Bonds!

RIGHT "ON THE Beam" FOR TRAINING MILLING MACHINE OPERATORS...

"MILLING PRACTICE" *Visual Training Course*

This Visual Training Program, consisting of five sound-slide films dealing with the fundamentals of milling practice, continues to prove highly popular with technical instructors and industrialists everywhere. Interestingly arranged, the films show many types of operations such as T-slotting, angular and straddle milling, circular milling, dovetailing, boring and end milling.

Many shop training directors report unusually successful results with this visual course. It is available on a rental basis at nominal cost. We invite you to write for full information to our Department of Industrial Education.

Kearney & Trecker *Products* CORPORATION
MILWAUKEE, WISCONSIN
Subsidiary of Kearney & Trecker Corporation

Kearney & Trecker CORPORATION
Milwaukee, Wisconsin

Mr. Johansson wants "Aircraft Finishes"

Norton Company
Worcester, Mass.

Gentlemen:

In my 18 years as foreman of our Grinding Department surface finish quality has been continually improved and inspection standards, especially in aircraft work, have become increasingly fussy.

In surface grinding, for instance, dimensional accuracy is no longer the only consideration. Chatters are definitely out. Now I find a demand for elimination of feed lines and those marks making up the pattern formerly accepted as typical of a ground surface finish.

Although we never produced anything like this in the past I feel such surface finish standards are here to stay and I would like any available assistance in getting immediate results on our 10" Norton surface grinders.

George Johansson

George Johansson,
Foreman, Dept. 6

GRINDERGRAM

A cool running grinding wheel spindle minimizes expansion and contraction, allowing uniform and more permanent bearing adjustment. Bearing temperatures are not, however, a true indication of bearing fit.

NORTON G
and

... the NORTON "doctor" suggests a REFINEMENT for SURFACE GRINDERS

THE balancing type wheel sleeve now available, Mr. Johansson, for Norton 10" and 12" Surface Grinders, while no panacea for poor spindle bearings or careless truing, may be of material assistance in obtaining better surface finishes.

Developed by Norton Engineering Service as one of many solutions for just such problems as your own, these wheel sleeves give a quick, easy and assured method of balancing the larger sizes of surface grinder wheels. With the machine in acceptable mechanical condition, such a sleeve should give that added degree of refinement to break up troublesome pattern conditions. Better wheel truing practice is another possibility with probable savings in wheel wear.

Again we say that a balancing wheel sleeve is no cure-all but may give you just that extra refinement in grinding practice needed to produce those "aircraft finishes".

NORTON COMPANY, Worcester, Mass.

M-480

GRINDERS
Lappers

Can the old horse

THE heavy demands placed upon our industrial machinery, today, have lowered its economic utility at a far faster rate than under peacetime conditions. Two and three-shift operation diminishes proportionately the number of calendar years in which these machines can be expected to operate efficiently.

Also, machinery shortages have caused many tools to be retained long after they should have been replaced. Their productive value is fast reaching the vanishing point. Quality and quantity of production cannot help but be materially decreased.

Thus, the question is serious as to whether our existing plant equipment will be able to meet postwar demands. Alert management is checking, now, the utility value of present machinery, to find out which can carry the postwar load, and which must be replaced with more up-to-date, cost-reducing tools.

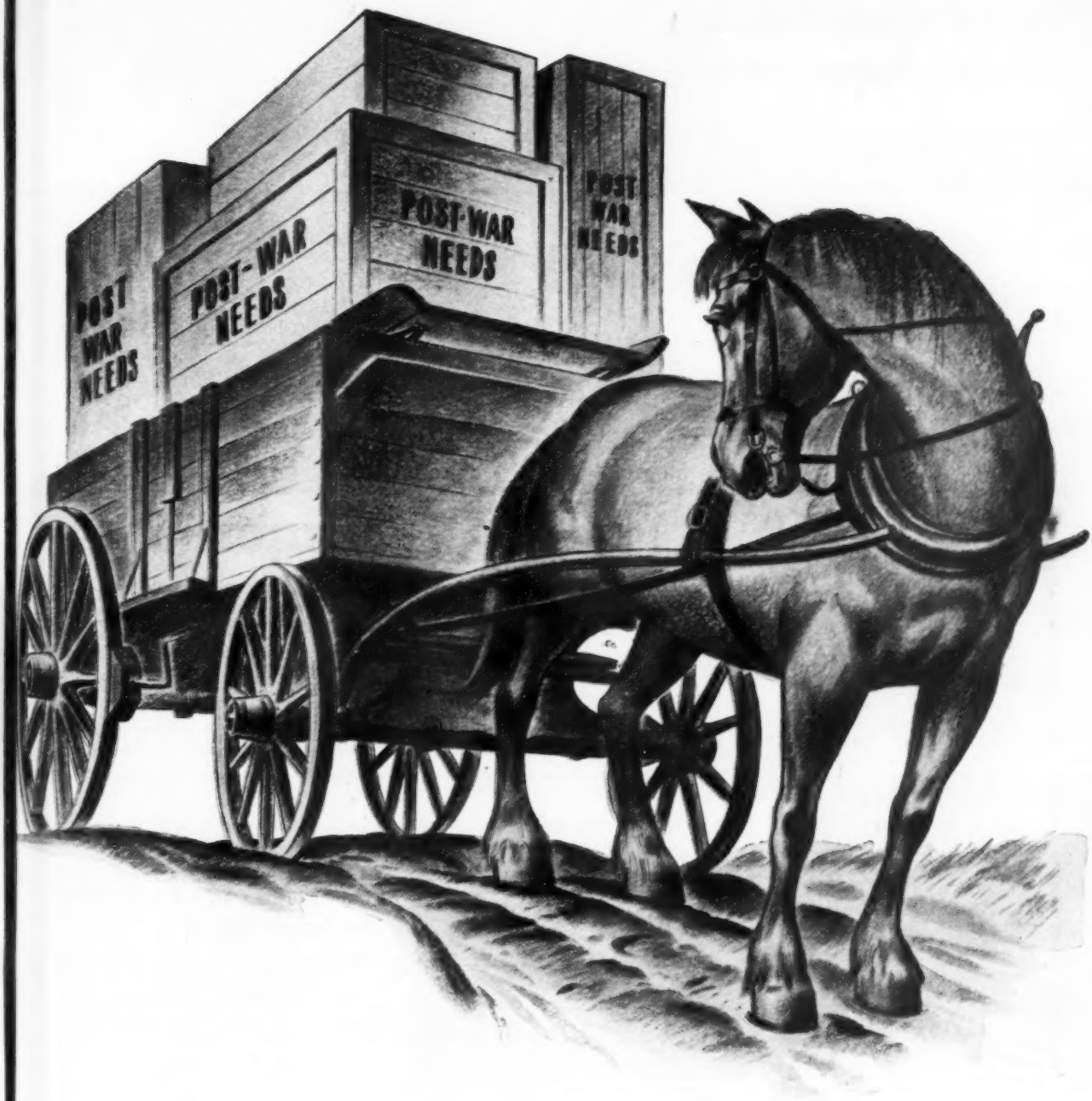
Also, to maintain American standards of wages and living, it is more and more necessary that we balance higher manpower rates with lower machine-power costs. Otherwise, we shall be placed at a severe disadvantage by the lower wages of our foreign competition, aided by the new machines which we have been shipping abroad, in such abundance.

The present pent-up demands for new products of all kinds will be released only to those manufacturers who are able to deliver good quality at reasonable prices. Only by the fullest utilization of the most highly efficient machine power, can we make more goods available to more people, at lower cost.

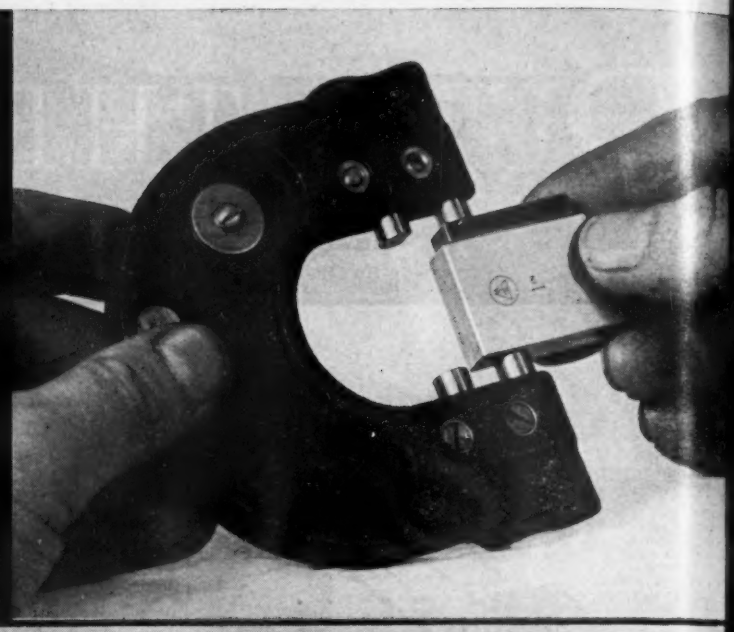
THE MONARCH MACHINE TOOL COMPANY · · · SIDNEY · OHIO

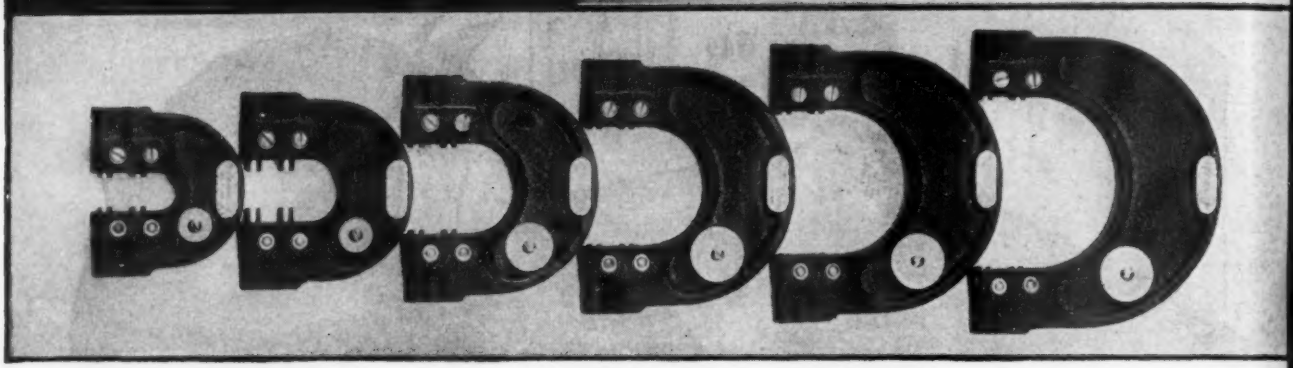
MONARCH LATHES
Save Time

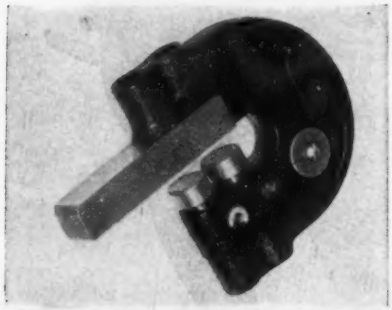
PULL THE LOAD?



YOUR PRODUCTION INSPECTION CAN BE SPEEDED WITH ATLANTIC ADJUSTABLE LIMIT SNAP GAGE SETS







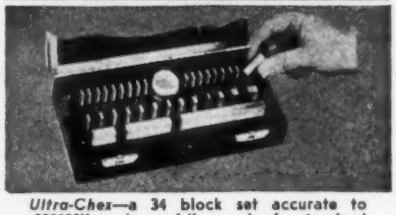
. . . SIZE RANGES FROM 0 to 6"

These sets provide the means for instant inspection with a minimum dependence on operator's skill. Even the novice (man or woman) can quickly become proficient in inspecting machined, turned or ground work. With these sets, all parts from the smallest size up to 6" diameter can be checked by the fast and acurate "go" and "no go" method. With several sets available, it is possible to select the one that comes within the range of your specific work.

An important feature of the "ATLANTIC" is the use of Meehanite frames to assure utmost rigidity and maintain the original form and shape of the frames. Long-lived accuracy, even in hard continuous service, can be depended on as a result of using this special metal in construction.

ATLANTIC ADJUSTABLE SNAP GAGES can be furnished with a wide range of special anvils for special work. Outline your requirements for quotation.

OTHER INSTRUMENTS IN THE SCHERR LIMITED BUDGET INSPECTION LABORATORY



Ultra-Chex—a 34 block set accurate to .000008" and providing a basic standard of measurements.

Magni-Ray—a wide field illuminated magnifier for close inspection of work and operations.

The Following Sets Are Available For Prompt Delivery

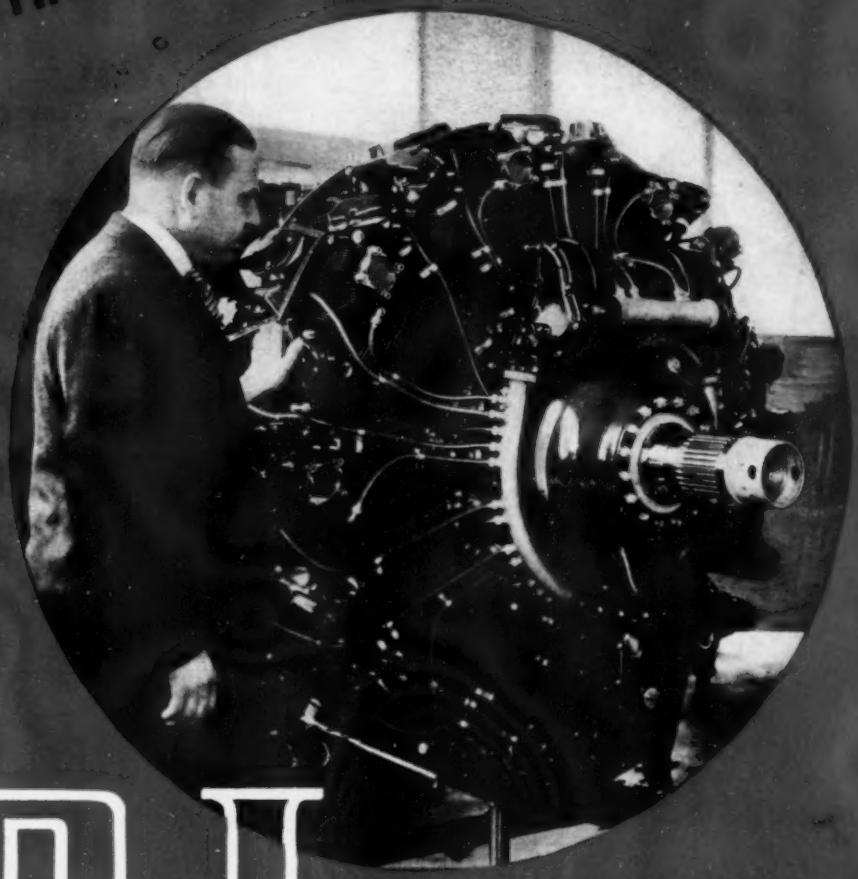
PRODUCTION SET No. 1— 6 gages Model A—range 0 to 3"	$34.81
PRODUCTION SET No. 2—10 gages Model A—range 0 to 6"	66.15
PRODUCTION SET No. 3—12 gages Model C—range 0 to 3 1/16"	82.51
PRODUCTION SET No. 4—19 gages Model C—range 0 to 5 11/16"	146.77

•

Specify production set required by number when ordering. All prices are net F.O.B. factory; gages are unset to size and unsealed. Kindly give complete priority information to expedite shipment. Further details on request.

GEORGE SCHERR COMPANY, INC.
124 LAFAYETTE STREET • NEW YORK, N.Y.

THE BATTLE AGAINST TIME
is being won



with

P&J *Automatic*

CHUCKING EQUIPMENT

P&J engineering ingenuity is given a free rein when it comes to tooling up for duplicate parts production. Problems involved in the machining of parts for airplane engines, for example, can be handled with outstanding results in speed and accuracy, thereby making it possible to reduce the assembly time of these highly important power plants for our battleships of the air.

This speed-up, contributed by P&J equipment, applies also to parts for tanks, Bofors guns, 90 mm anti-aircraft guns, machine guns, adaptors for shells, the American Aerlikon gun—in fact for a host of parts involved in offensive and defensive weapons of war. P&J's own production facilities are geared to the war effort to provide the machines which are contributing to the great successes being achieved in the Battle of Production.

Get more parts there quicker with more **WAR BONDS**

The POTTER & JOHNSTON MACHINE CO., *Pawtucket, R. I.*

Presenting MID-WEST'S "B" BOND WHEEL *for* GRINDING TUNGSTEN CARBIDE

NOW, after more than a year of the most severe tests known to mechanical science, we formally present the MID-WEST "B" BOND WHEEL, designed and built especially for grinding tungsten carbide parts.

For more than a year, while our "B" BOND wheels were being used in production plants throughout the United States, we restrained our pride, refrained from mentioning them in any advertising. Our factory tests told us we had produced a GOOD wheel for tungsten carbide grinding. But we wanted to be certain our engineers had produced a BETTER, MORE EFFICIENT wheel for that type of work.

And now we know! Now we know the MID-WEST "B" BOND WHEEL, by virtue of its splendid performance in actual production usage, is worthy of the MID-WEST label. MID-WEST "B" BOND WHEELS have three outstanding features: THEY CUT FASTER. THEY CUT COOLER. THEY CUT SMOOTHER.

Order MID-WEST "B" BOND WHEELS today. Reasonably prompt delivery.

Mail Today

Gentlemen: *Please send me further details on MID-WEST "B" BOND GRINDING WHEELS.*

Name _____

Address _____

MID-WEST ABRASIVE COMPANY

Manufacturers of DEPENDABLE Abrasives

1960 E. MILWAUKEE AVENUE DETROIT, MICHIGAN

RIVETT

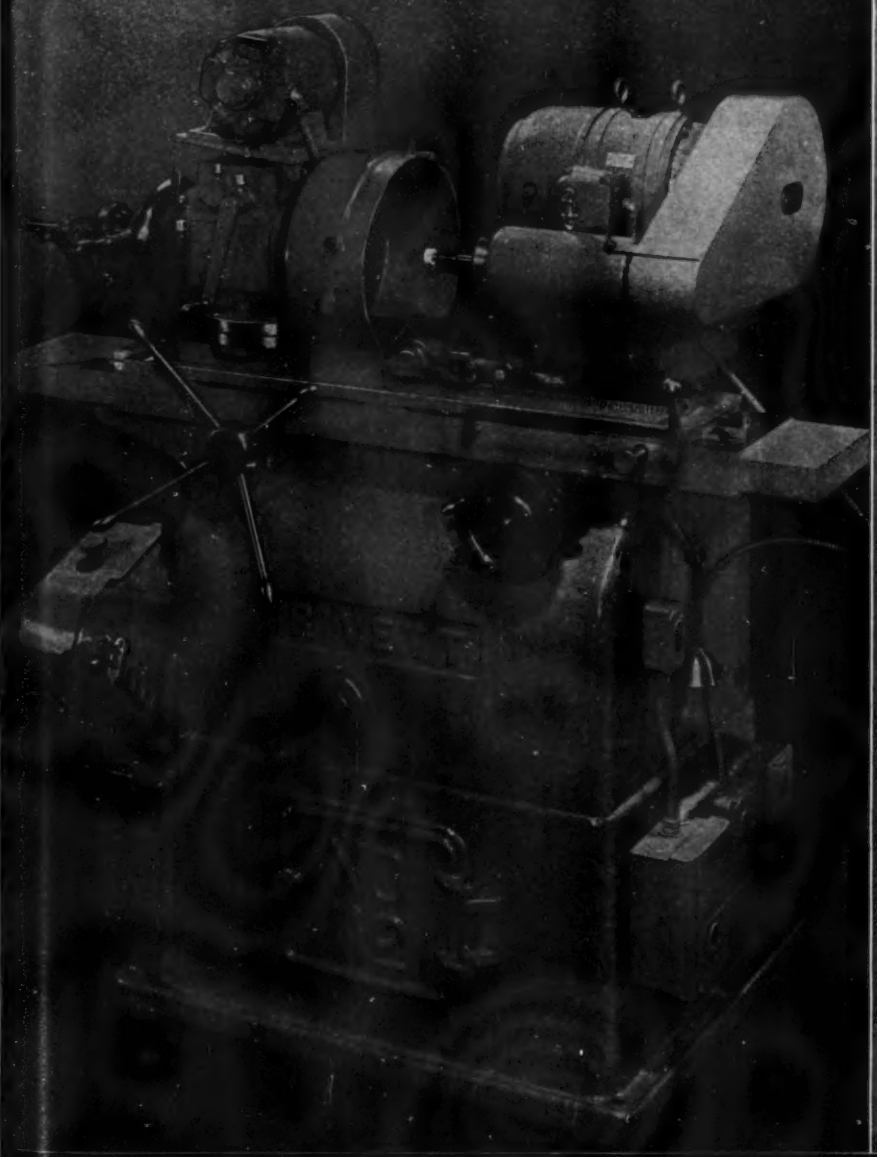
112 UNIVERSAL GRINDER

For Straight, Taper, Bevel or Straight and Bevel Grinding

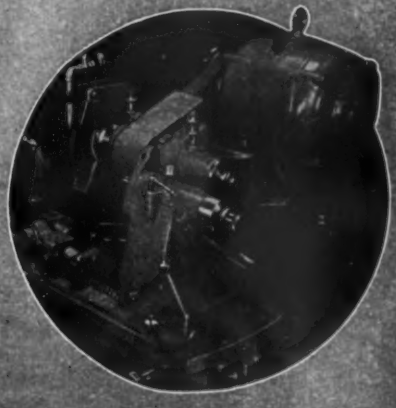
The Rivett No. 112 Universal Precision Grinder is primarily for tool-room work. Available internal and external spindles in combination with many adjustments make possible a great variety of grinding operations. Extreme simplicity of design enables any mechanic familiar with grinding to operate the machine.

Work may be held in collet, step chuck, jaw chuck or fixture and driven at required speed. Power table reciprocation may be set at one of eighteen selective speeds from 10 to 86 passes per minute. Length of table travel is adjustable between ½" and 8". High or low speed internal bracket or external spindle bracket, all as illustrated, may be quickly interchanged as required on cross slide. Workhead, table and cross slide are swivelled individually or in combination for taper and bevel grinding.

ARMY NAVY



High Speed Internal Spindle



External Spindle and Tailstock

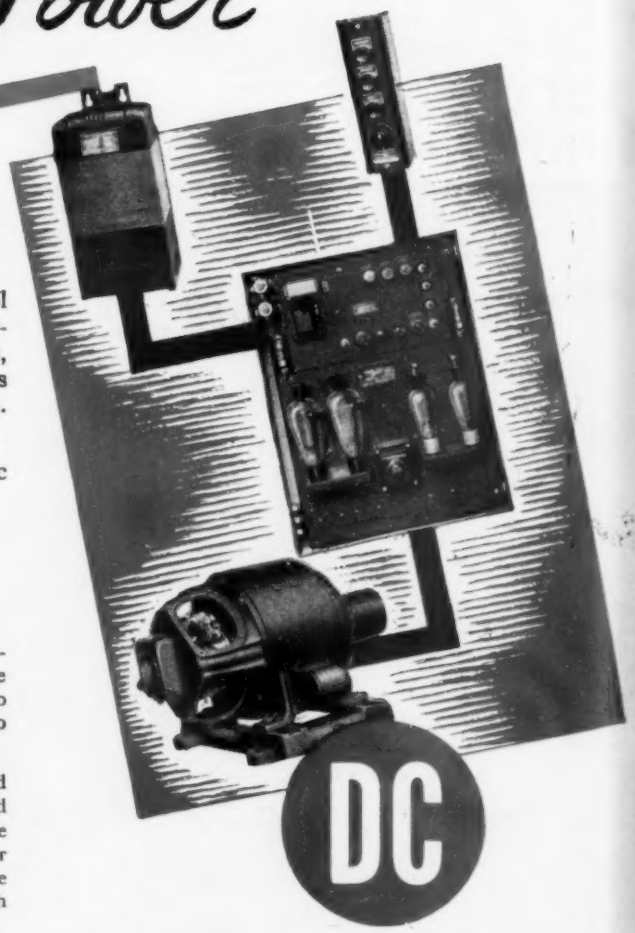
SPECIFICATIONS

Grinding cap., hole dia.	¼" to 3"
Grinding cap., outside dia.	up to 8"
Automatic table travel	½" to 8"
Table speeds	18 selective
Hand table travel	16"
Swing over table	14"
Workhead swivel	90°
Table swivel	5°
Cross slide swivel	90°
Cross feed graduations	.0005"
Travel of cross slide	3½"
Collet capacity	1"
Step chuck capacity	8"
Jaw chuck capacity	8"
Workhead spindle speeds	150, 380, 600 r.p.m.
Grinding spindle speeds:	
Standard int.	4600 and 10000 r.p.m.
High speed int.	25000 r.p.m.
External	3300 r.p.m.
Automatic Oil Lubrication	
Net weight with motors	3700 lbs.

For Further Description Write for Bulletin 112

RIVETT LATHE & GRINDER INC.

Now Electronics Gives You Full-range Variable-speed Drive from AC *Power*



G-E THY-MO-TROL DRIVE Provides Full Control on a Single Dial

- **Complete Drive—Nothing Else to Buy.** Thy-mo-trol drive is a complete equipment, its d-c motor operating from your a-c power line. Starts, accelerates, controls speed, stops by dynamic braking, and reverses the motor—all from a single, compact control station. And it fully protects the motor.

  Makes available previously unused advantages of d-c motors, such as:

  1. **Full-range, Stepless Speed Control**
  2. **Constant Speed under Changing Load**
  3. **Full Torque at Low Speeds**
  4. **Smooth, Fast Current-limit Acceleration**

- **Dozens of Other Thy-mo-trol Extras . . .** such as: low maintenance (by elimination of moving parts); preset speed before starting; space saving; no stop for speed change; easy to control automatically; operation direct from a-c line—no motor-generator or other special d-c supply needed.

- **Where Has It Been Applied?** Drill presses, to increase speed range and kinds of work handled. Grinders, for precise speed selection and improved finish. Milling machines, to increase variety of work handled, and to simplify design. Propeller governor testing, for accurate, smooth speed control. Cable reelers, to maintain constant tension. Conveyors, to match speeds.

- **How to Buy Thy-mo-trol Drive.** Because electronic motor control offers so many advantages through improved machine design, performance, and operating technique, G-E engineers want to consider each of your problems as an individual case. Standard Thy-mo-trol drives can be obtained in sizes up to 10 hp. Special types can also be provided. For further information write, stating your problem, to any G-E office, or to General Electric, Electronic Control Section, Schenectady, New York.

THY-MO-TROL DRIVE is easy to install. These four compact units—d-c motor, electronic panel, compact control station, and small power transformer—make up the complete drive.

ANOTHER G-E *"FIRST"* IN INDUSTRIAL ELECTRONICS

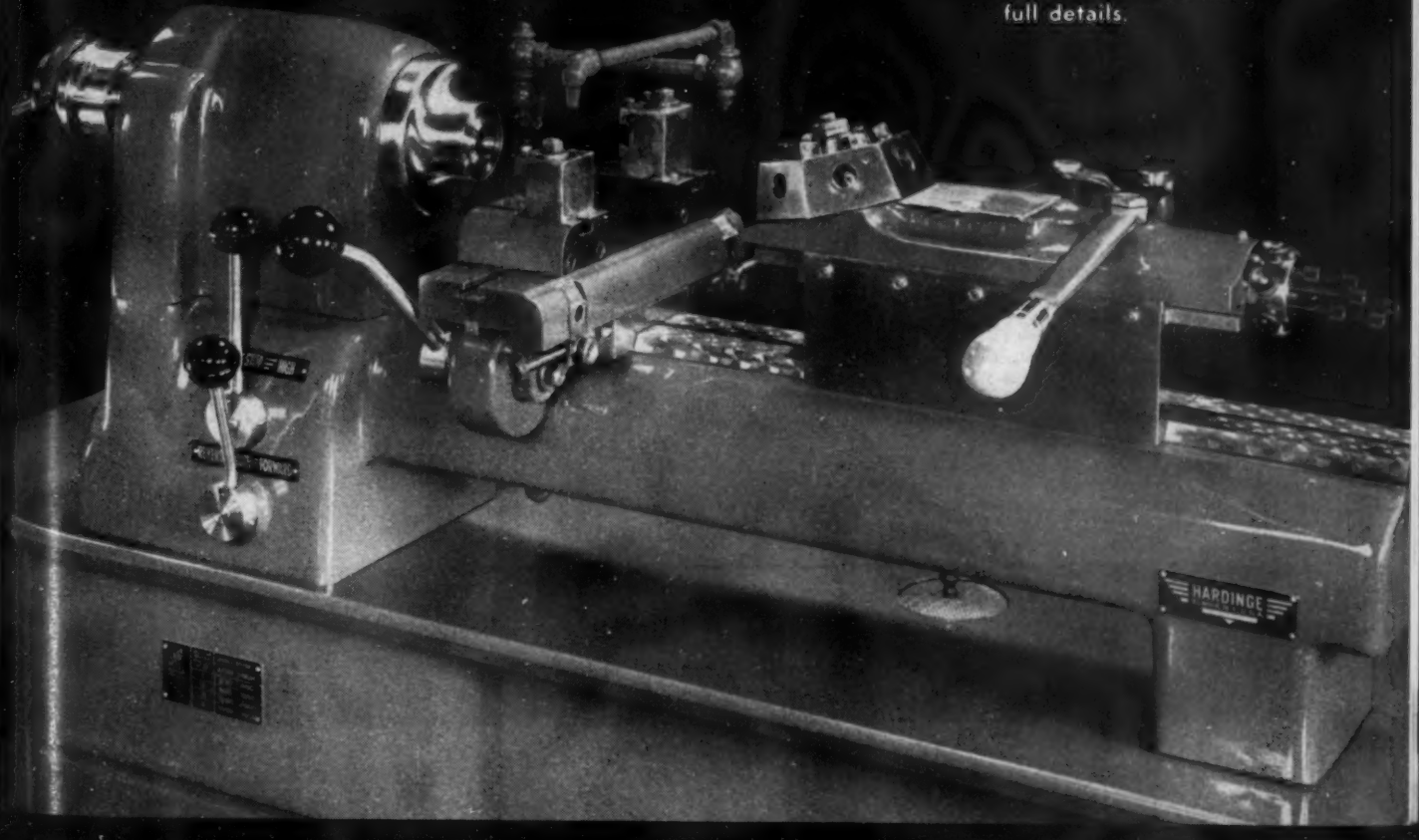
GENERAL ELECTRIC

HARDINGE
ELMIRA, N.Y.

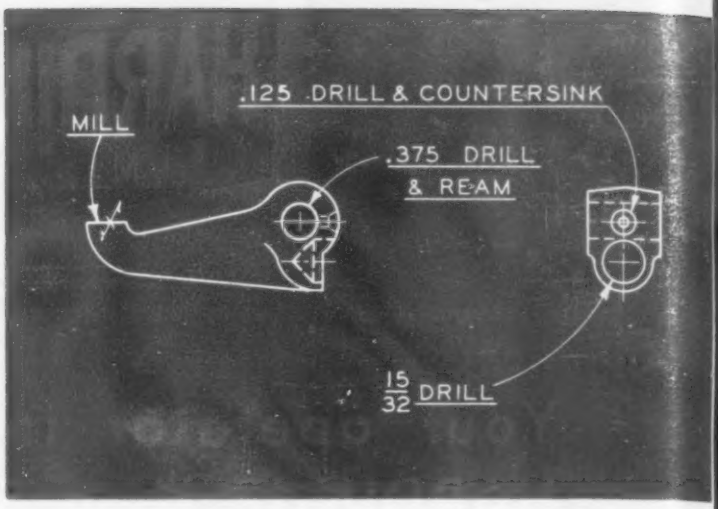
Your operator in front of this HARDINGE High Speed Precision Second Operation Machine will result in: lower costs
better finish
greater accuracy
less fatigue

Ask for this 8 page bulletin which gives full details.

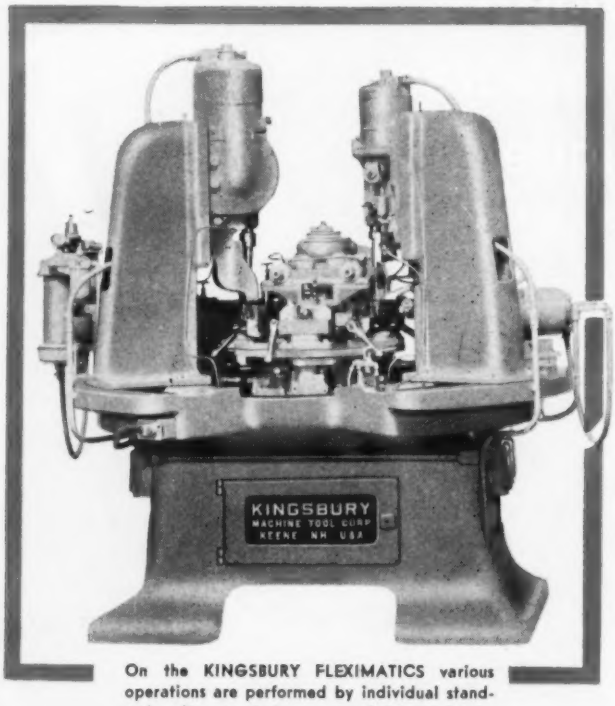
CAPACITY:
1/16" to 1" with collets
1" to 6" with step chucks
1" to 5" with jaw chucks
Spindle Speeds: 230 to 4000 R. P. M.



Automatic transmission parts automatically produced at top speed



FLEXIMATIC



On the KINGSBURY FLEXIMATICS various operations are performed by individual standard units mounted on several types of subbases. Only a single chucking of the work is required regardless of the number of different operations involved. By this method of arranging standard automatic units, a unique combination of machining operations can be provided for as well as a flexibility in the machine for whatever change-overs may be necessary with a change in the nature of the work to be handled.

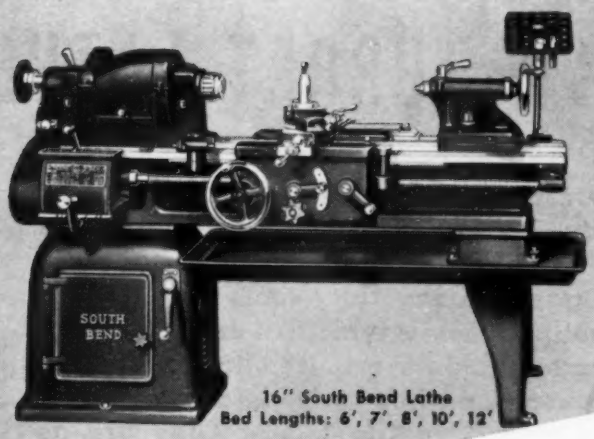
by KINGSBURY

Drilling, reaming and milling forged steel levers for automatic transmissions are handled by this Model GD FLEXIMATIC in a single chucking of the work. Fixtures employed are hand operated, self-centering, two-jaw chucks.

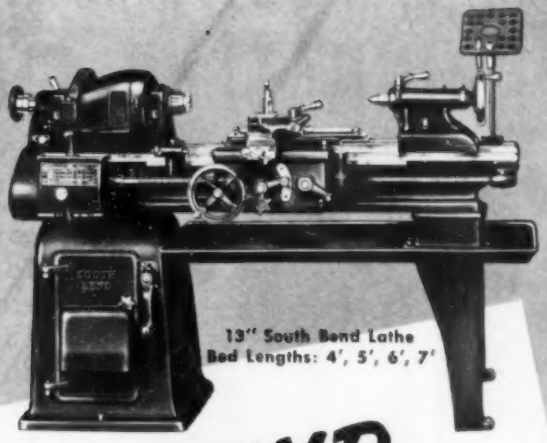
The same principle of handling multiple operations which makes the FLEXIMATIC so highly productive on this job can be applied to other classes of work. That is why FLEXIMATICS are playing such a big part in today's all-out war program—turning out precision parts on a high production basis—performing drilling, reaming, tapping, counterboring, spot facing and other operations on intricate work and meeting the most rigid specifications.

All operations on FLEXIMATICS occur simultaneously. The time for one piece is the time for the longest single operation only—an advantage which not only means outstanding time savings but also savings in man-hours per piece. With FLEXIMATICS man power at machines is vastly more productive.

KINGSBURY MACHINE TOOL CORPORATION
KEENE NEW HAMPSHIRE U.S.A.



16" South Bend Lathe
Bed Lengths: 6', 7', 8', 10', 12'



13" South Bend Lathe
Bed Lengths: 4', 5', 6', 7'

SOUTH BEND LATHES

Engine Lathes · Toolroom Lathes · Turret Lathes

Time, material, and manpower can be saved for vital work if you use the right lathe for every job. The matching of the job and the lathe has never been more important than it is today—in no other way can maximum production be obtained. Remember that versatility and precision are important in a toolroom lathe. For manufacturing operations, a lathe must also have plenty of power, speed, and stamina.

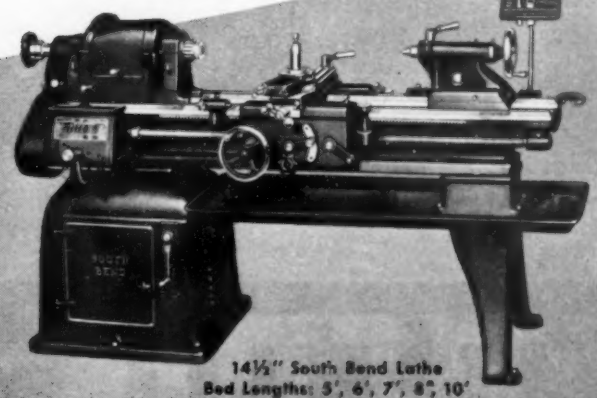
South Bend Engine Lathes are made in 9", 10", 13", 14½", and 16" swings, with bed lengths from 3' to 12'. The Toolroom Lathes are made in 10", 13", 14½", and 16" swings, with bed lengths from 3' to 8'. The Turret Lathes are made in 9" and 10" swings, with 3½' bed lengths. These lathes are described in Catalog 100C which will be sent upon request.

SOUTH BEND LATHE WORKS
South Bend, Indiana
Lathe Builders For 36 Years

10" South Bend Turret Lathe

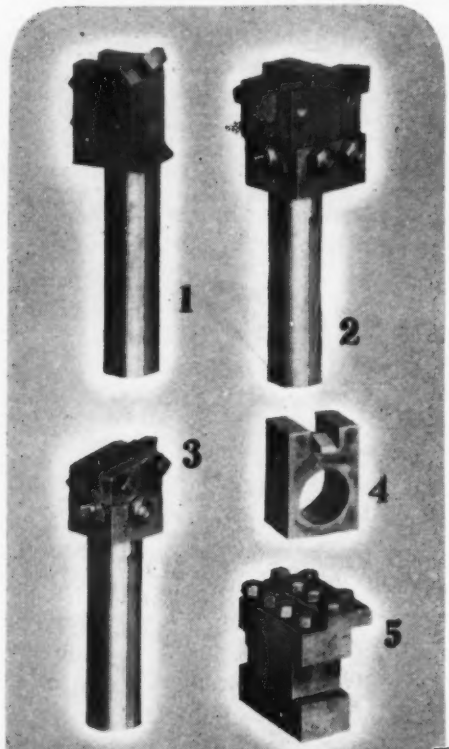
9" South Bend Lathe
Bed Lengths: 3', 3½', 4', 4½'

10" South Bend Lathe
Bed Lengths: 3', 3½' 4', 4½',



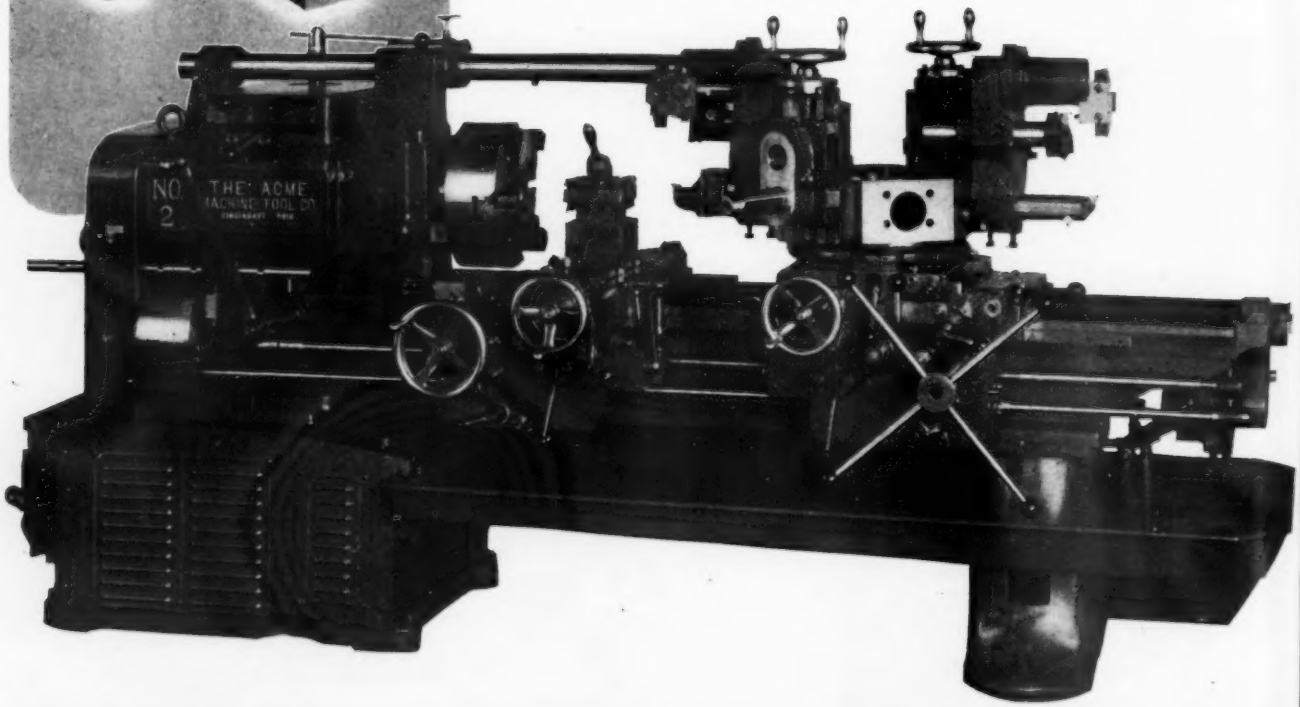
14½" South Bend Lathe
Bed Lengths: 5', 6', 7', 8', 10'

Tools of TODAY *for* TOMORROW'S *Production*
CINCINNATI ACME TURRET LATHES



● A Turret Lathe is no better than its tooling capacity. This Cincinnati Acme Universal Turret Lathe is designed and built for modern, rugged, heavy duty tools used today. This group of tools is typical of the new heavy duty cutter holders required to handle the high speeds and heavy feeds demanded of carbide tipped cutting tools. They are as follows: No. 1 Offset "X" Cutter Holder, No. 2 Reversible and Adjustable Straight and Angle Cutter Holder, No. 3 Adjustable Angle Cutter, No. 4 Cutter Head for Stub Boring Bar, No. 5 Multiple Tool Block for Square Turret.

All of these are adaptable to the 1-S and 2-S Acme Turret Lathe illustrated. Modern heavy duty tools on Acme Turret Lathes provide greater production—consistent accuracy and lower costs.



The ACME MACHINE TOOL CO.
... CINCINNATI, OHIO.

ARMSTRONG

This war is being won with High Speed Steel in Armstrong Tool Holders

Victory begins in the tool rooms and machine shops, for striking power first takes form in jigs, fixtures and dies . . . in more and more machine tools, each operating continuously at the highest possible speeds and feeds.

Since the capacity of any machine tool is limited to the efficiency and capacity of its cutting point, we can afford, today, only the strongest and most efficient cutting tools with the finest cutting edge. This means, for all general lathes, planers, slotters and shapers and for many screw machine and turret lathes, the correct ARMSTRONG TOOL HOLDER with a cutter bit of high speed steel.

With high speed steel so essential to top efficiency, so widely needed and with our national supply so difficult to maintain, to waste high speed steel in forged tools is to delay victory because the same high speed steel consumed in one forged tool would supply high speed steel cutters for 10 ARMSTRONG TOOL HOLDERS —would go 10 times as far, would do 10 operations instead of one, would machine 10 times as many dies of jigs. Use ARMSTRONG TOOL HOLDERS wherever possible to "Save: All Forging, 70% Grinding and 90% High Speed Steel." This war is being won right now in jigs and fixtures, made and maintained with High Speed Steel in the ARMSTRONG TOOL HOLDERS used in over 96% of the machine shops and tool rooms.

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"

315 N. Francisco Ave. **Chicago, U. S. A.**

199 Lafayette St., New York
Eastern Warehouse and Sales:

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms

Friction Fighter ROLLER BEARINGS

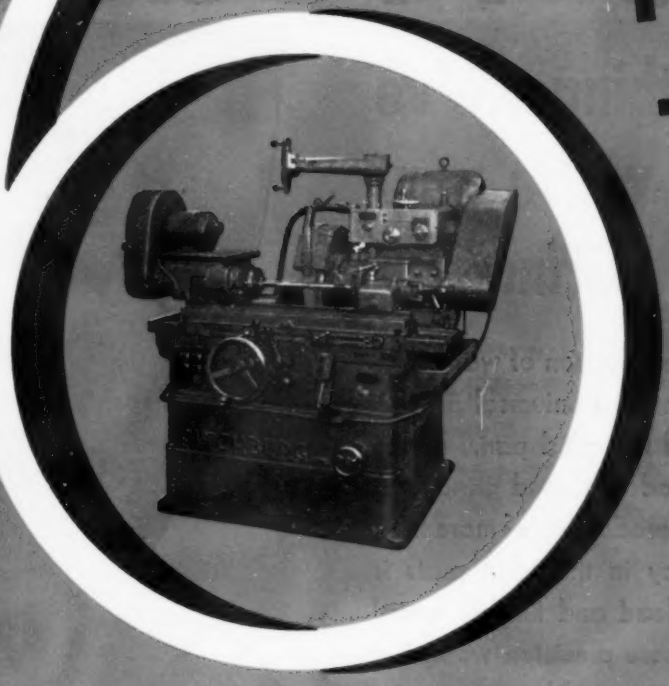
CARRY SHOCK LOADS WITH FULL-LENGTH ROLLER CONTACTS

Anton J. Haug of Nashua, N. H., selected Friction Fighter roller bearings for his pulp refiner shown above, because he knew these bearings are capable of standing up under the strain of severe service. Weighing 20 tons, the largest of its kind, this machine converts 35 to 40 tons per day of rejects from a chemical pulp mill into high grade pulp. Shock loads and high temperatures under wet, dirty operating conditions are all taken in stride by the three Friction Fighter roller bearing units, as indicated by the arrows above.

Loads are distributed over rollers and races providing reserve capacity, effectively absorbing shock loads and vibration. Inherent self-aligning feature of concave rollers running between convex races permits unrestricted compensation for shaft deflection or misalignment without disturbing bearing load contact so that high load carrying capacity of roller bearing is maintained under all operating conditions assuring maximum durability. Link-Belt Friction Fighter Bearings are available without mountings in both roller and ball types or as pillow blocks and units of cartridge, flange, take-up, hanger and duplex types. Link-Belt Company —Indianapolis, Chicago, Philadelphia, Atlanta, Dallas, San Francisco, Toronto. Branch Offices, Warehouses and distributors in principal cities.

9131

LINK-BELT
FRICTION FIGHTER
BEARINGS
Roller and Ball Types



FITCHBURG TYPE "B" GRINDER

New 6" Plain Cylindrical Automatic Precision Grinder

The Fitchburg Type "B" 6-inch automatic precision grinder features new engineering principles that result in more economical production of plain cylindrical parts. It is designed for greater accuracy and finer finish—with completely automatic cycles—rapid traverse to work, correct feed, grinding dwell and rapid return. In fact, it is equipped with every modern feature necessary to normal or wartime production.

So versatile is this grinder that its production adaptability permits both small lots of parts or continuous repetitive work to be handled with efficiency and economy. It is a grinder of entirely new design with all mechanisms readily accessible and ease of operation assured by centralized controls.

Write today for complete details and information about machines with 18" and 32" capacity.

FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U. S. A.

Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Both Full Universal Grinders and Special Purpose Grinders.

"How to Produce B

. . . is one important thing we've learned in this war—we're now using Ex-Cell-O Thread Grinders."

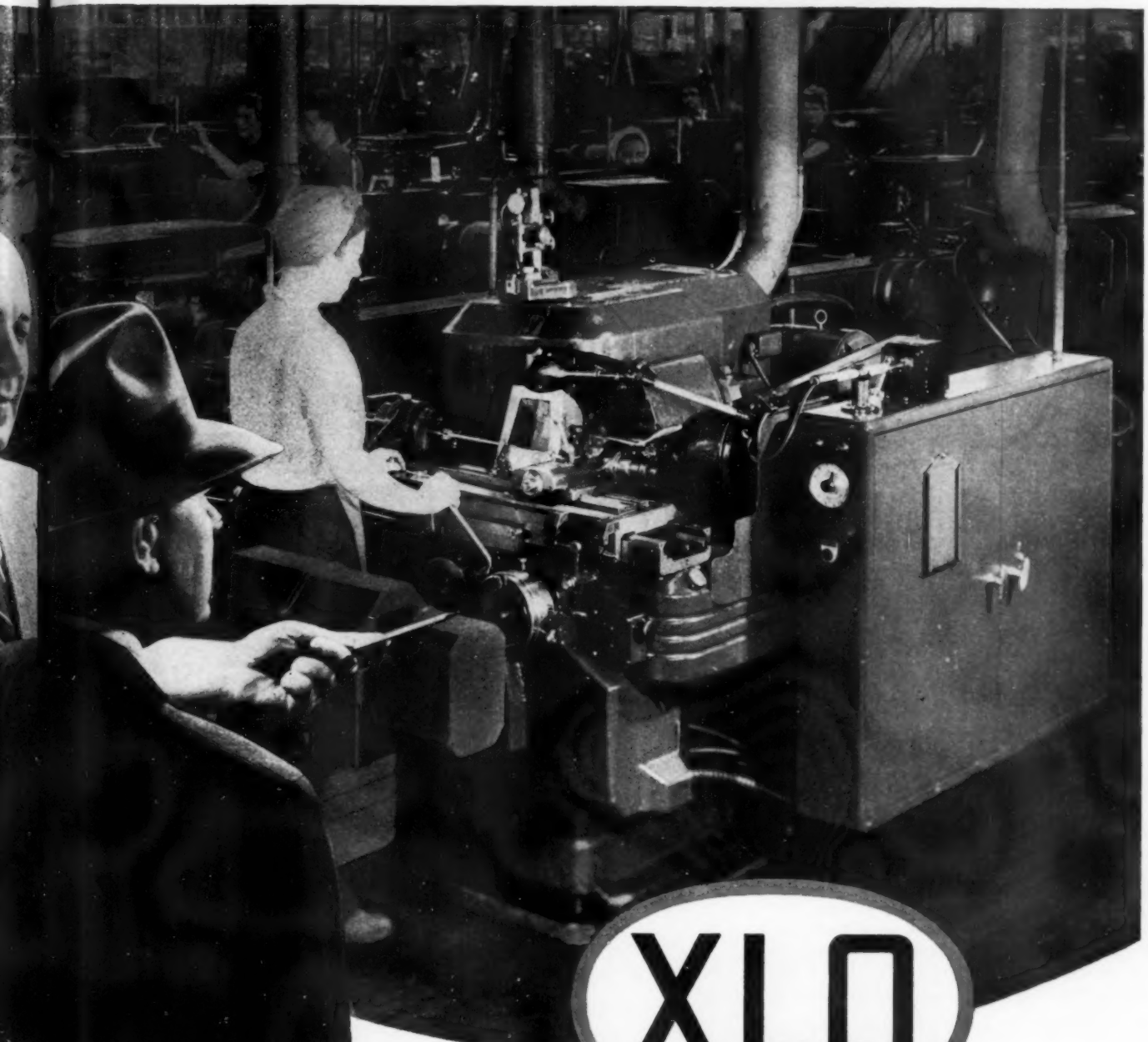
The supreme need for accuracy in today's production of war material has made *precision thread grinding* almost a universal process among manufacturers turning out hardened threaded parts. In the aircraft industry, for instance, the use of modern thread grinders is a recognized factor in today's phenomenal production of more than 7,000 planes a month. Wherever accuracy in threaded parts is essential—accuracy of thread form, size, lead and finish—thread grinding is important. Not only does it assure precision work, but almost invariably it means increased production and lower costs . . . and the reduction in service failures of the parts when in use. Ex-Cell-O has developed precision thread grinding to cover the many requirements of American industry for precision threaded work, for the grinding of internal as well as external threads. There are nine different styles of Ex-Cell-O precision thread grinders—all standard machines—making possible a very wide range of threaded work.

EX-CELL-O CORPORATION • DETROIT

To left: Ex-Cell-O book on Thread Systems, Forms, and Measurements that contains much practical information for all those using Precision Thread Grinding Machines. A request for a free copy of this new book, on your business letterhead, will be given immediate attention.

PRECISION THREAD GRINDING, BORING AND LAPPING MAC
GRINDING SPINDLES • BROACHES • CONTINENTAL CUTTING TOO
EQUIPMENT • PURE-PAK CONTAINER MACHINES RAIL

eBetter Threads...

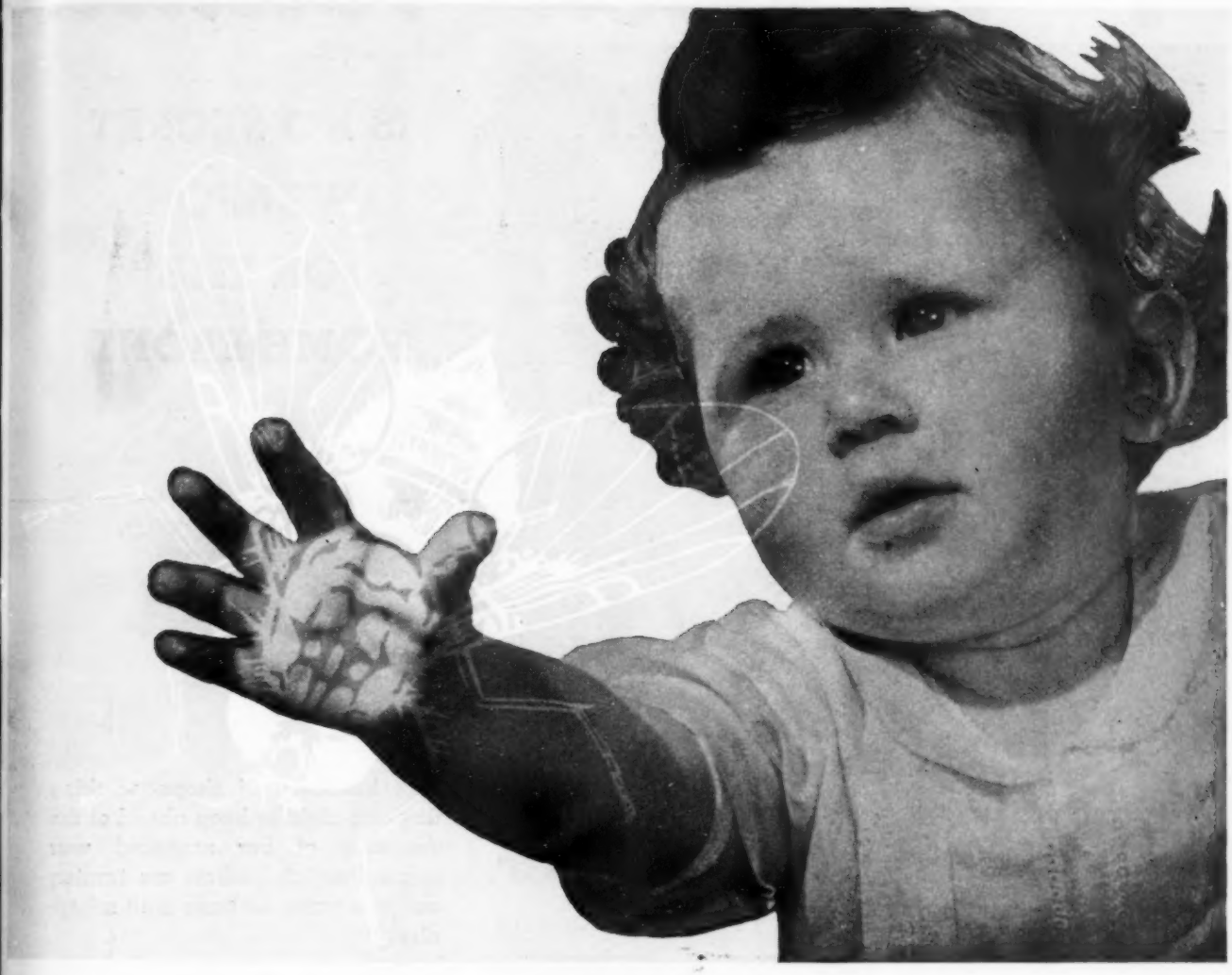


XLO

EX-CELL-O *for* PRECISION

NG MACHINES • TOOL GRINDERS • HYDRAULIC POWER UNITS
NG TOOLS • DRILL JIG BUSHINGS • DIESEL FUEL INJECTION
ES RAILROAD PINS AND BUSHINGS • PRECISION PARTS

It's the "HOLD" that Counts!
KEMPSMITH RUGGEDNESS AND POWER SCORE ANOTHER PRODUCTION VICTORY
If you own a Kempsmith Milling Machine, you can wrestle with practically any machining problem. Here, for example, is a Type G machine being utilized for facing and tee-slotting a large saddle casting — a job for a boring mill, NOT a miller. A large face plate, rigidly mounted on the spindle, revolves while the cutting tool is held by a tool-post on the table. Unusual? Yes, indeed! Yet accurate machining is performed on a fast, production basis. Just another example of Kempsmith ruggedness and adaptability.
KEMPSMITH MACHINE CO., Milwaukee, Wis., U. S. A.
KEMPSMITH
• Precision Built • Milling Machines Since 1888 •



Your child's best friend...

THE PARASITIC FRUIT FLY, Drosophila, is perhaps the most important creature in the world to scientists today. Because its study may reveal what the character of our own children may be in the future.

Drosophila is a perfect specimen for laboratory study, because a generation flickers past in from 8 to 12 days. As a result, scientists have been able to study and record a million breedings! And the entire mechanism of heredity has thus been revealed!

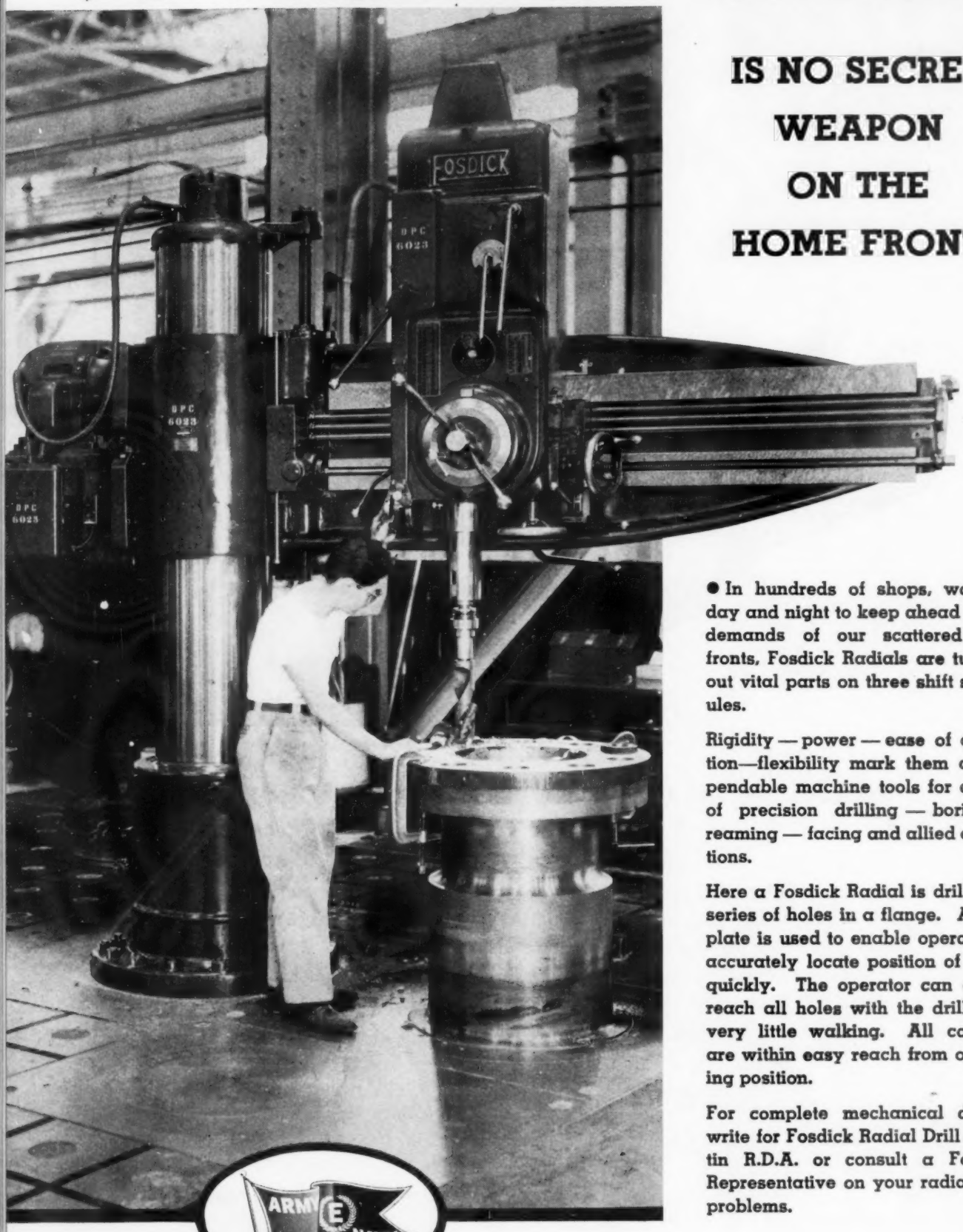
But if Drosophila is a friend to mankind, consider the influence of machine tools on human welfare. Do you know why it is that some countries, so rich in natural resources, still harbor hundreds of millions living close to starvation? And why the highly industrialized countries represent the greatest advance in civilization? The answer is machine tools!

Machine tools have vastly increased the output of manufacturers and have shortened the customary hours of labor. They have **not** reduced the number of persons required to do the world's work. They **have** eliminated much of the back-breaking labor which would otherwise be required.

Cone Automatic Machine Company is proud to be a part of such an essential industry. Proud, also, to know that whatever we Americans build for the future, Cone Multiple Spindle Automatic Lathes will most certainly enter into much of its production.

ONE Automatic Machine Company, Inc., Windsor, Vermont

A Fosdick Radial



IS NO SECRET WEAPON ON THE HOME FRONT

● In hundreds of shops, working day and night to keep ahead of the demands of our scattered war fronts, Fosdick Radials are turning out vital parts on three shift schedules.

Rigidity — power — ease of operation—flexibility mark them as dependable machine tools for a host of precision drilling — boring — reaming — facing and allied operations.

Here a Fosdick Radial is drilling a series of holes in a flange. A template is used to enable operator to accurately locate position of holes quickly. The operator can easily reach all holes with the drill with very little walking. All controls are within easy reach from operating position.

For complete mechanical details write for Fosdick Radial Drill Bulletin R.D.A. or consult a Fosdick Representative on your radial drill problems.

FOSDICK MACHINE TOOL COMPANY
CINCINNATI · · · OHIO

sidetracked AT NOON

HAULING STEEL 48 HOURS LATER

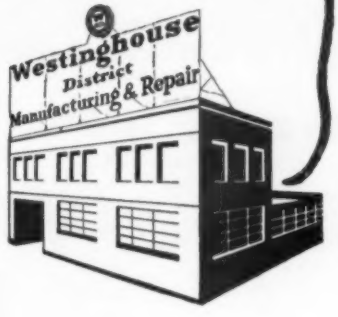
STEEL HAULING STOPPED WHEN MOTOR ARMATURE IN 15-TON LOCO-MOTIVE FAILED. ARMATURE DELIVERED TO WESTINGHOUSE DISTRICT MANUFACTURING AND REPAIR PLANT SAME EVENING. COMMUTATOR WAS DISMANTLED, V-RING MACHINED AND REBUILT. BARS CUT BACK AND NEW V'S MACHINED. MOTOR ASSEMBLED AND BACK IN LOCOMO-TIVE—HAULING STEEL 48 HRS. LATER.

Westinghouse

DISTRICT MANUFACTURING AND REPAIR

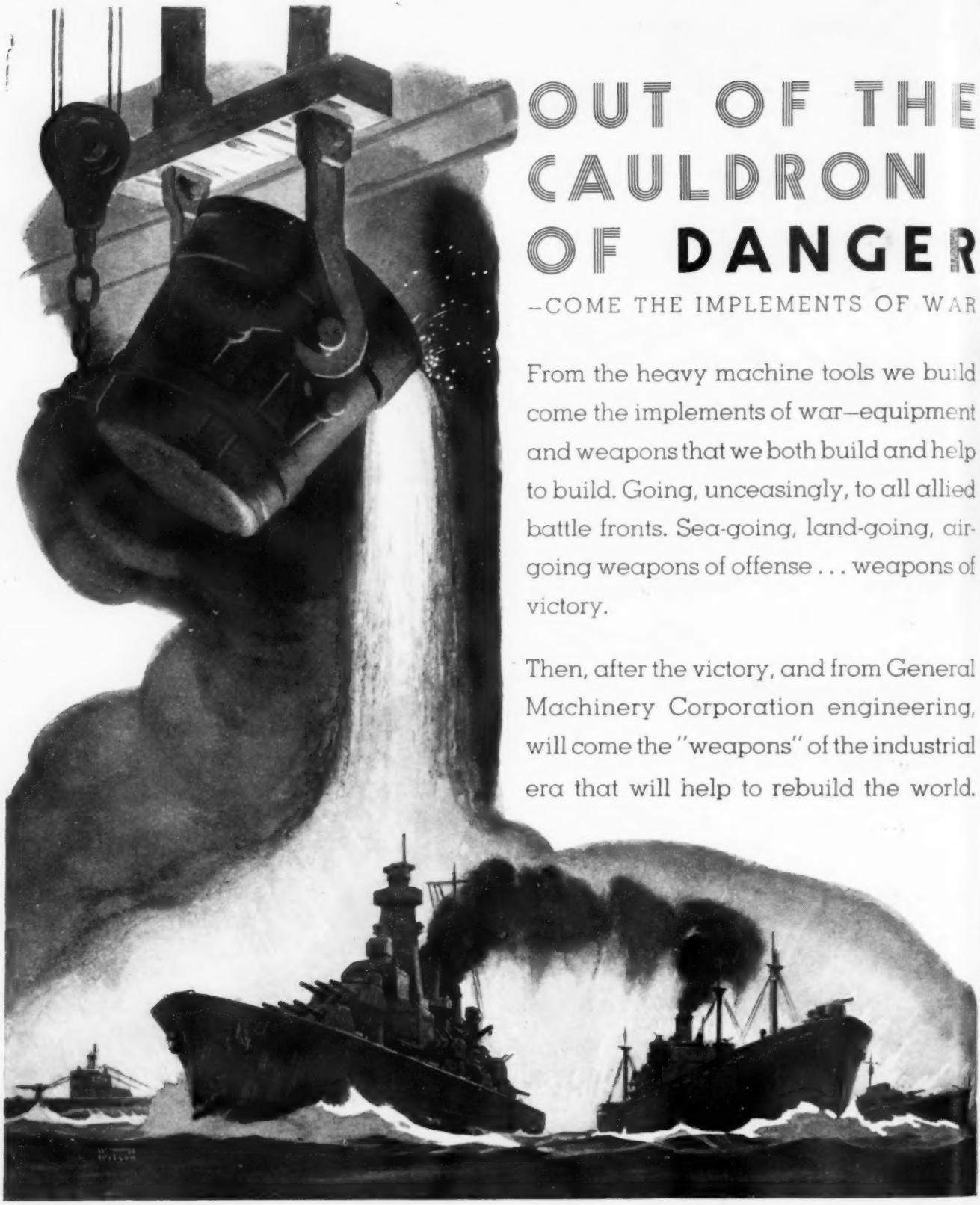
J-90465

***IF* THE EQUIPMENT NEEDING REPAIR IS VITAL TO THE WAR EFFORT . . . PHONE THE NEAREST OFFICE OF WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY FOR**



EMERGENCY SERVICE

33 M & R PLANTS . . . ONE NEAR YOU!



OUT OF THE CAULDRON OF DANGER

—COME THE IMPLEMENTS OF WAR

From the heavy machine tools we build come the implements of war—equipment and weapons that we both build and help to build. Going, unceasingly, to all allied battle fronts. Sea-going, land-going, air-going weapons of offense . . . weapons of victory.

Then, after the victory, and from General Machinery Corporation engineering, will come the "weapons" of the industrial era that will help to rebuild the world.

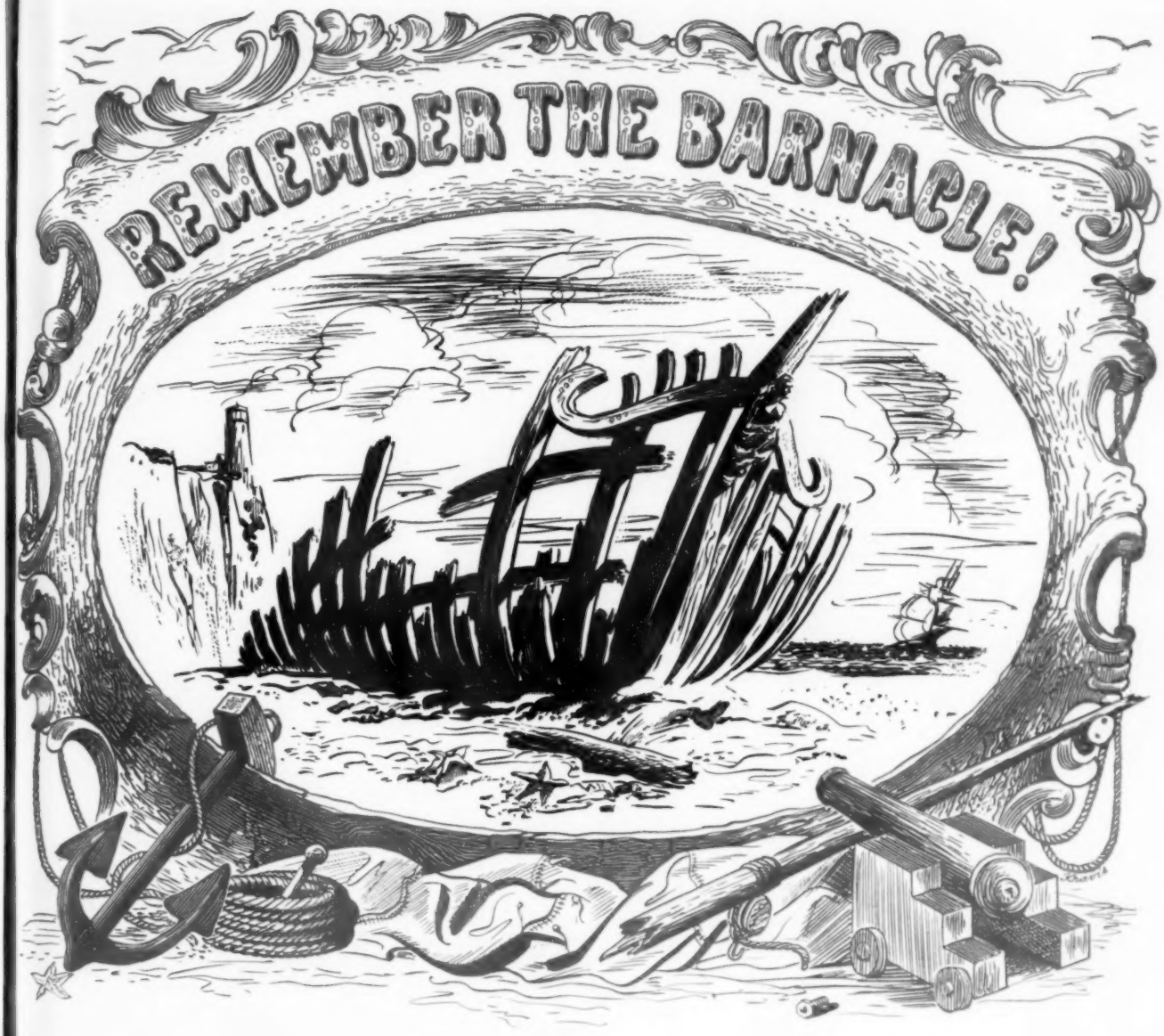
GENERAL MACHINERY CORPORATION

HAMILTON, OHIO

THE NILES TOOL WORKS CO.

THE HOOVEN, OWENS, RENTSCHLER CO.

GENERAL MACHINERY ORDNANCE CORPORATION



With that curtly classic reminder, one of America's most famous research engineers replied to a man in the act of rhapsodizing about the wonderful ingenuity of man.

For the barnacle, he pointed out, is a symbol of all those things that have *not* been done—a tiny marine organism that costs us millions every year—simple, "impossible" things that are still to be accomplished.

The development of lighter and stronger alloys, permitting 3, 5, or even 10 horsepower for every pound of engine weight, instead of one-to-one . . . cheaper color photographs and faster engravings and better television . . . swifter ways of making and working new super-hard alloys . . . scores of different kinds of rubber "growing" on factory floors, and fuels 3 or 4 times as powerful as 100-octane gasoline . . . even solar energy, and atomic power, and—remember the barnacle! These are but a few from a list of certainties and possibilities as long as man's imagination.

Under the secrecy of forced-draught war research, many incredible accomplishments—seemingly impossible within our time—have already occurred. For obvious reasons, these may not be discussed, but of one thing we can be certain: The end of this war will inaugurate the greatest era of industrial surprises since the age of machinery began.

And the shift to light metals and plastics may be as consequential as the shift from bronze to iron!

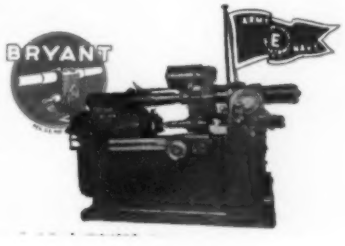
We at Bryant have developed many new techniques during the past few months. Our engineers are working on hundreds of production lines today, helping to solve production problems involving the machining of hard rubber, plastics, glass, graphite, cast iron and bronze, as well as forged, centrifugally cast and surface-hardened steels, light metals and alloys from a hundred new specifications.

If this wealth of new experience can be of value to your business, it's there for the asking. For Bryant's Consulting Service on internal grinding is available to you at all times.

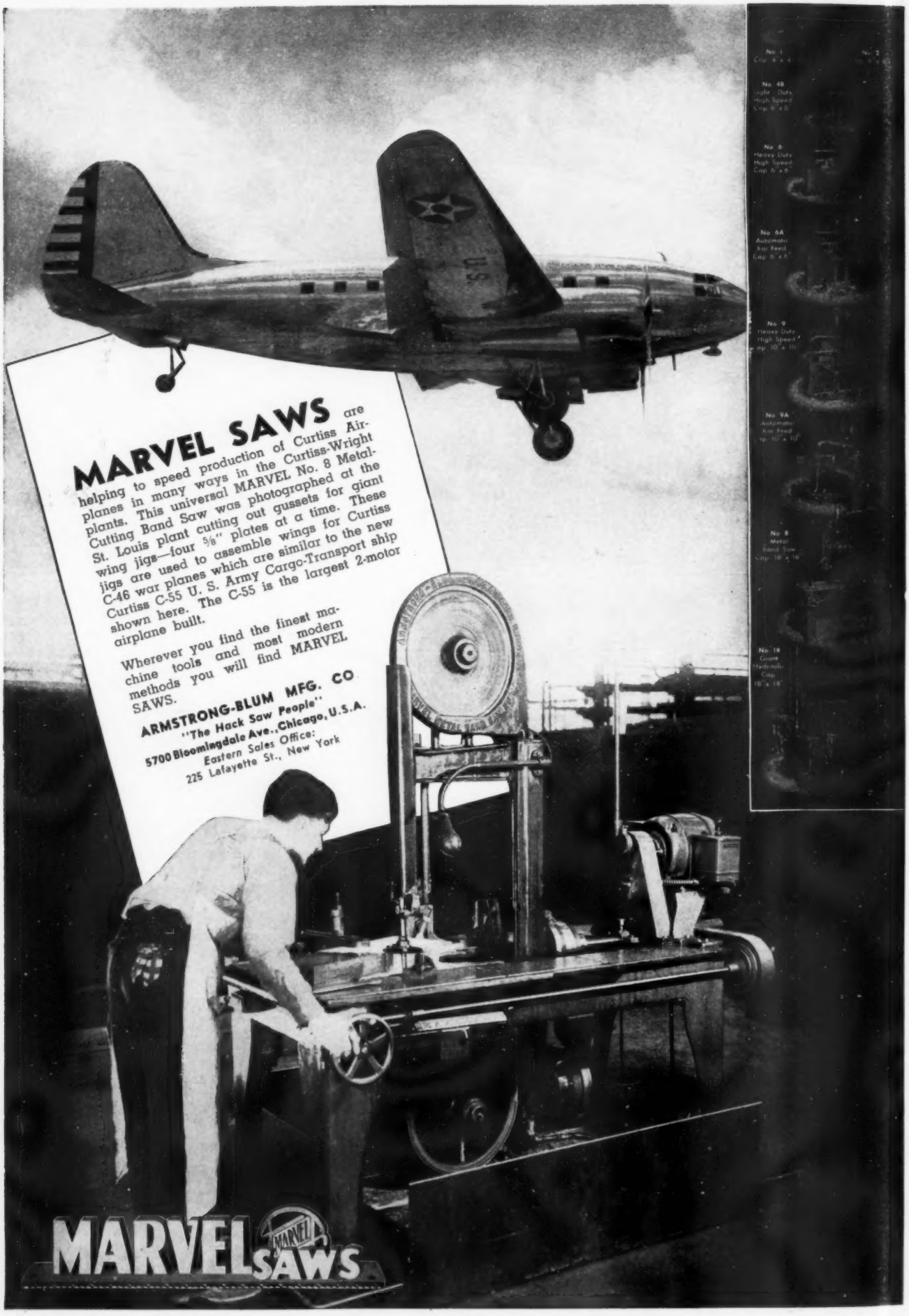
Call upon us now!

Bryant Chucking Grinder Company

SPRINGFIELD, VERMONT, U. S. A.



SEND FOR THE MAN FROM BRYANT

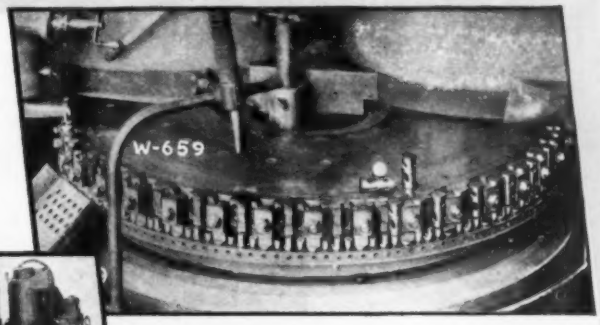

MARVEL SAWS
helping to speed production of Curtiss Airplanes in many ways in the Curtiss-Wright plants. This universal MARVEL No. 8 Metal-Cutting Band Saw was photographed at the St. Louis plant cutting out gussets for giant wing jigs—four 5/8" plates at a time. These jigs are used to assemble wings for Curtiss C-46 war planes which are similar to the new Curtiss C-55 U. S. Army Cargo-Transport ship shown here. The C-55 is the largest 2-motor airplane built.
Wherever you find the finest machine tools and most modern methods you will find MARVEL SAWS.
ARMSTRONG-BLUM MFG. CO
"The Hack Saw People"
5700 Bloomingdale Ave., Chicago, U.S.A.
Eastern Sales Office:
225 Lafayette St., New York
MARVEL SAWS
No. 4B
No. 6
No. 6A
No. 9
No. 9A
No. 8
No. 18

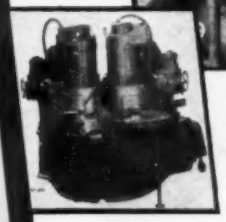
"PUT IT ON THE BLANCHARD"

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

- **Production**
- **Adaptability**
- **Fixture Saving**
- **Operation Saving**
- **Material Saving**
- **Fine Finish**
- **Flatness**
- **Close Limits**

. . . . . *Especially valuable on jobs like the one illustrated.*





Grinding Valve Tappets on No. 16-A2 Blanchard Automatic Surface Grinder.

THE job illustrated is one of several sizes of chilled cast iron tappets being ground on a Blanchard No. 16-A2 Automatic Surface Grinder.

The operator drops the work into pockets in the continuously revolving 80 station fixture, which automatically clamps, unclamps, and ejects the pieces. Accurate sizing is insured by the wheel control calipers, which automatically feed the heads down to compensate for wheel wear. Dividing the work between roughing and finishing wheels makes it possible to obtain both excellent finish and high production.

1/32" of stock is removed from the solid end of these tappets to limits of ± .001" and square within .001" across the diameter. 2600 pieces are produced per hour.

For quantity and quality production of small parts the Blanchard No. 16-A2 Automatic Surface Grinder is outstanding.

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE, MASS.

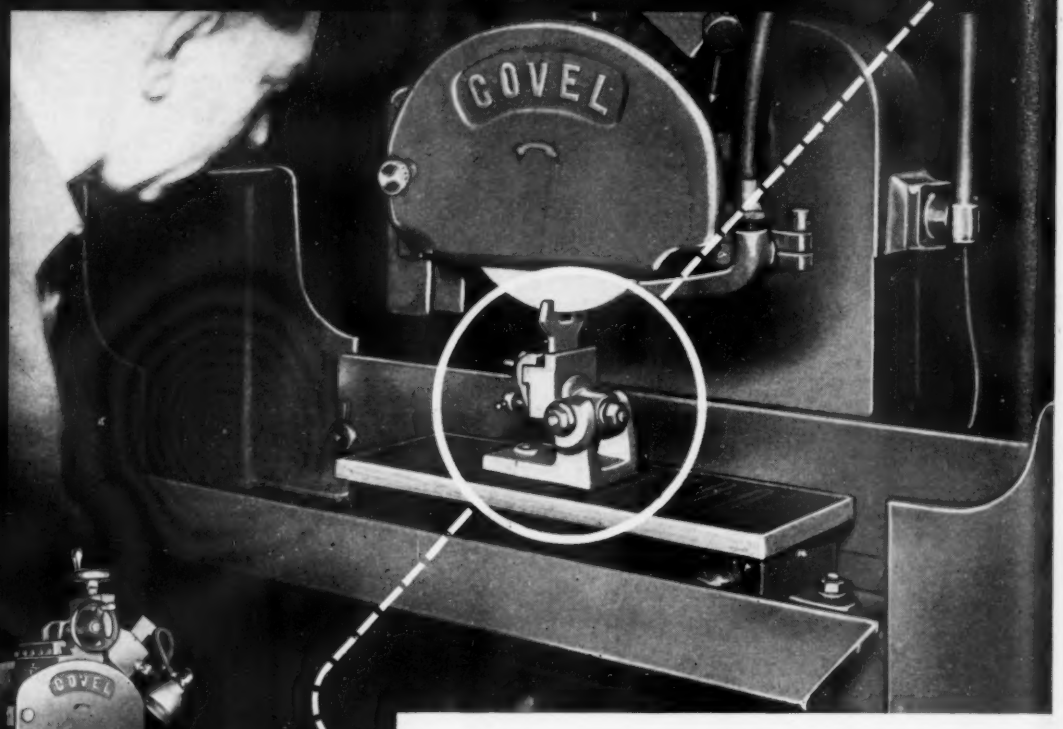
BLANCHARD

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

ACCURATE *Gage* GRINDING

SHORTEN EMPLOYEE TRAINING TIME WITH COVEL EQUIPMENT

PROMPT DELIVERY TO WAR INDUSTRIES



With the COVEL NO. 20 HAND FEED SURFACE GRINDER

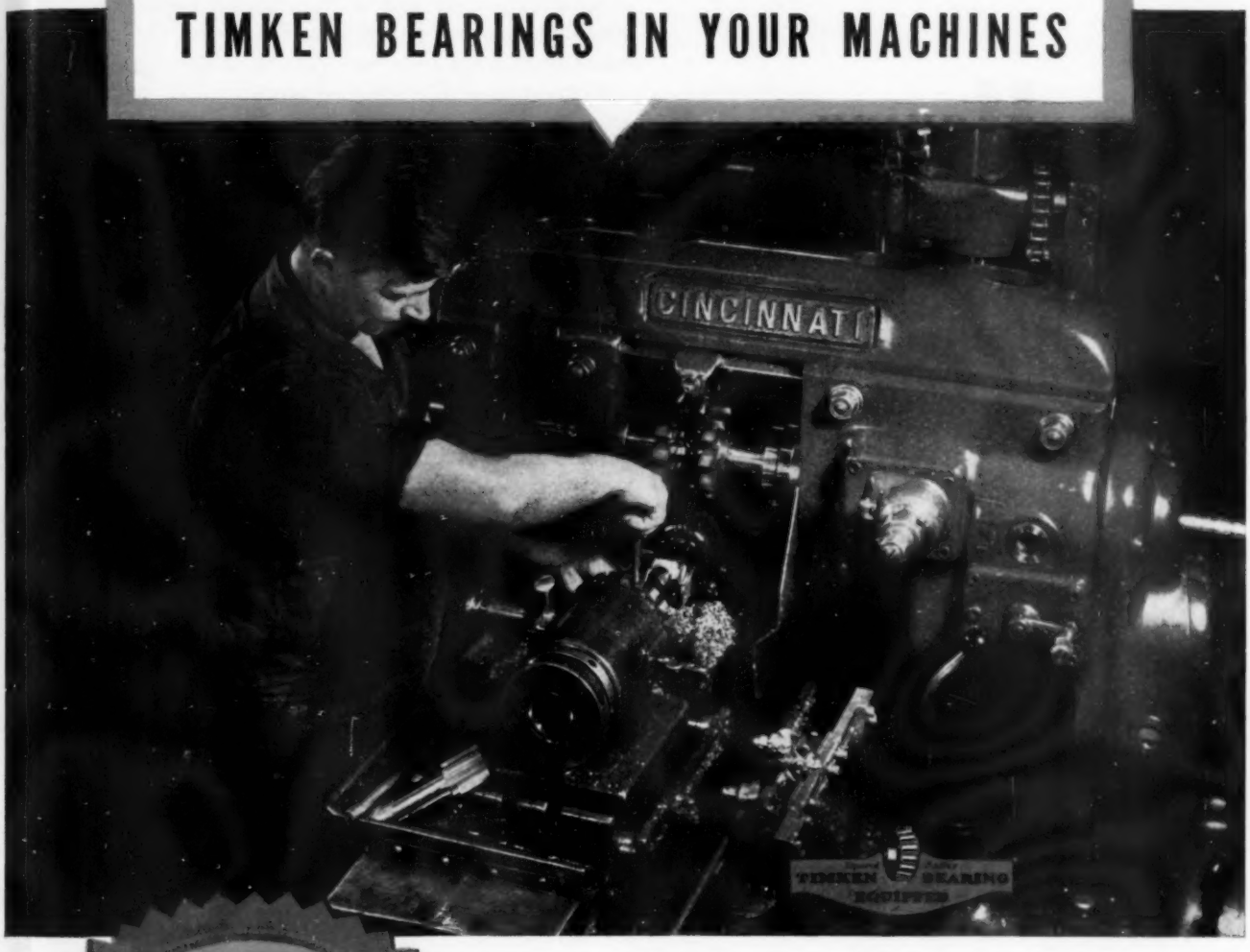
No instruments or tools are more essential than gages in producing the precision weapons of modern warfare. And gage accuracy requires GRINDING accuracy—extreme precision such as that provided by Covel's No. 20 Surface Grinder. The ability of these high-speed machines to grind to split-hair tolerances has been proven in countless plants and tool rooms throughout the country . . . Eighteen outstanding high-production features of No. 20 (6"x18") Surface Grinder are detailed in Covel's Bulletin A-133 — write, wire or phone today for your copy and name of nearest dealer.

Grinding Machinery Since 1874

COVEL INDUSTRIAL GRINDERS

COVEL MFG. CO., BENTON HARBOR, MICH.

MAKE EVERY MINUTE COUNT WITH MORE TIMKEN BEARINGS IN YOUR MACHINES



Cincinnati No. 2-24 Automatic Rise and Fall Milling Machine equipped with Timken Bearings on the spindle and at other important positions.

If you wait to see what will happen after Victory you may be too late. Take stock of the probable situation now and get your equipment ready for it. Redesign if necessary, to use Timken Bearings at every suitable position.

Any machine may be a good machine even though it does not have any Timken Bearings in it—but it will be a far better machine if it is Timken Bearing Equipped; and the more Timken Tapered Roller Bearings it contains the better it will be in performance, endurance and economy.

Above all, spindles should be mounted on Timken Bearings for maximum and sustained precision; this is a modern "must". After spindles come gear boxes, feed mechanisms and other positions.

Are your machines keeping ahead of all production requirements for Victory? Will they be capable of holding their own in post-victory competition? There's one way to make sure — more Timken Bearings. The Timken Roller Bearing Company, Canton, Ohio.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

COPYRIGHT 1943, BY THE TIMKEN ROLLER BEARING COMPANY

Honing

helped change the "Horseless Carriage" Into AUTOMOTIVE TRANSPORTATION

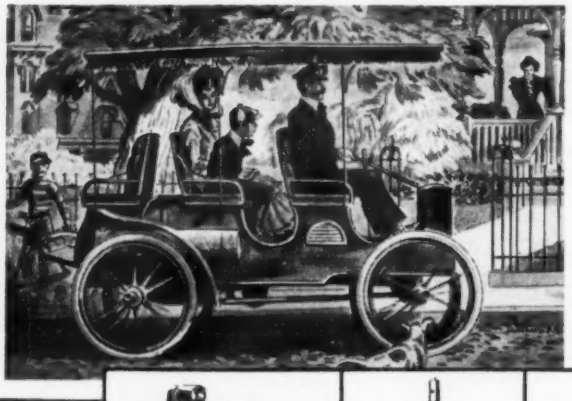
Yesterday—The horseless carriage and its immediate successors proved that a "newfangled contraption" could become an everyday useful device. Its early success could not have been possible without grinding—the first controlled abrading process.

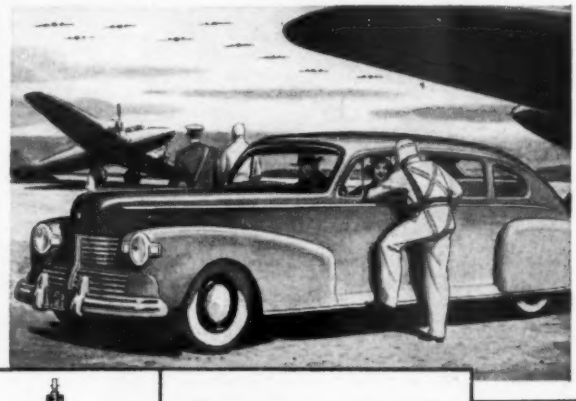
Today—The beautiful sturdy automobile is a marvel of mechanical development and efficiency. It can be well made in millions where its predecessor was poorly made in hundreds. HONING, which provides further control of abrading action, made it possible to make this refined mechanical job in huge quantity.

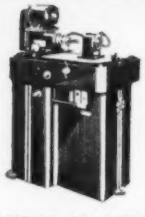
Tomorrow—Nobody knows what mechanical devices may suit the public need, or catch the public fancy, tomorrow. Postwar planning is not yet definite. But as today's equipment came from yesterday's developments, so tomorrow's will derive from today's. Most of the things we will use tomorrow are already developed.

One thing is certain—mechanical devices used tomorrow will demand better control of machining methods.

And Micromatic has been developing hone abrading controls to be ready for that demand.







HONING MACHINES

HONING TOOLS

HONING FIXTURES

ABRASIVE STICKS

Micromatic HONE CORPORATION

Detroit, Michigan

MAKERS OF HONING MACHINE TOOLS

The NEW Army Mule Also . . . Must Be Sure of Its Bearings

The dependable instinct of the four-legged army mule has been proverbial in all wars. He is always sure of his "bearings" wherever he goes.

The new army mule—the jeep—also must be sure of its "bearings." Tough as it appears to the eye, the jeep, like all military vehicles, couldn't take the rough going if it did not have maximum accuracy in its precision bearings.

Its bearings and other critical surfaces are finished by Microhoning—the modern abrading process which removes stock at rates up to 65 cubic inches per hour, generates accuracy for roundness and straightness of bore within .0002″ to .0003″, and, any desired surface finish.

Besides making the new mule sure of its "bearings," Microhoning has many other applications in war and peace.

Write for Bulletin A. R. 67

Some Microhoned Automotive Bores

Cylinders
Con Rods Large End
Hydraulic Brake Cylinders
Crankshaft Main Bearing
Crankshaft Pin Bearing Bores
Cam Shaft Bearing Bores
Valve Guides
Hydraulic Shock Absorbers

MICRO MATIC

MICROMATIC HONE CORPORATION
DETROIT, MICHIGAN

To the natural advantages of magnesium, Mazlo Magnesium products add their own superior qualities . . .

Magnesium is *super,* when it comes to machinability. It cuts at high speeds and feeds, taking a fine finish. Part costs are consequently lower, especially so where machine tools can be run at speeds which take full advantage of this property of magnesium.

In Mazlo Magnesium products supplied by American Magnesium Corporation, you can expect greater accuracy, uniformity and finer details. Credit this to skill in manufacturing gained in more than twenty years of working with magnesium. This may mean less allowance needed for finishing, less metal to remove, lower machining losses, when you put Mazlo Magnesium products through your plant.

In addition, remember in working with magnesium to translate the per-pound cost into what it costs per-piece. Magnesium weighs less than one-fourth as much as the heavy metals. You'll discover, therefore, that this lightweight metal permits new economies, if you've been in the habit of figuring costs on a weight basis.

Today, of course, you can't get Mazlo Magnesium products for civilian uses. But be planning to profit by its higher strength-weight ratio in making your postwar designs. Sales Agent: Aluminum Company of America, 1709 Gulf Building, Pittsburgh, Pa.

MAGNESIUM MAZLO PRODUCTS

REG. U.S. PAT. OFF.

AMERICAN MAGNESIUM CORPORATION

SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA

Prompt Delivery? **Yes!**
But with Strict Adherence to Accuracy on "STANDARD" *Seasoned*

PLUG GAGES

PROMPT DELIVERY

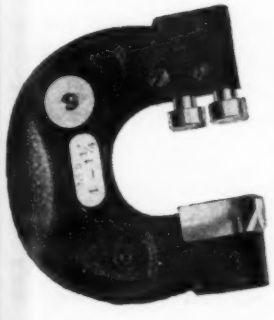
THE ACCURACY and economy of "STANDARD" Plug Gages is a byword and a "buy word" wherever precision parts are made. Even in today's constant clamor for *SPEED*, the material, craftsmanship and accuracy of "STANDARD" Gages are faithfully maintained.

Conserve Vital Gage Steel . . . Increase the Life of PLUG GAGES with Hard Chrome Plating

Salvage worn Plug and Ring Gages, save vital gage steel and conserve man and machine time with Hard Chrome Plating by STANDARD. Applied to new Gages as well as to Gages worn below original size, their life is increased 3 to 5 times.

STANDARD

Snap Gages



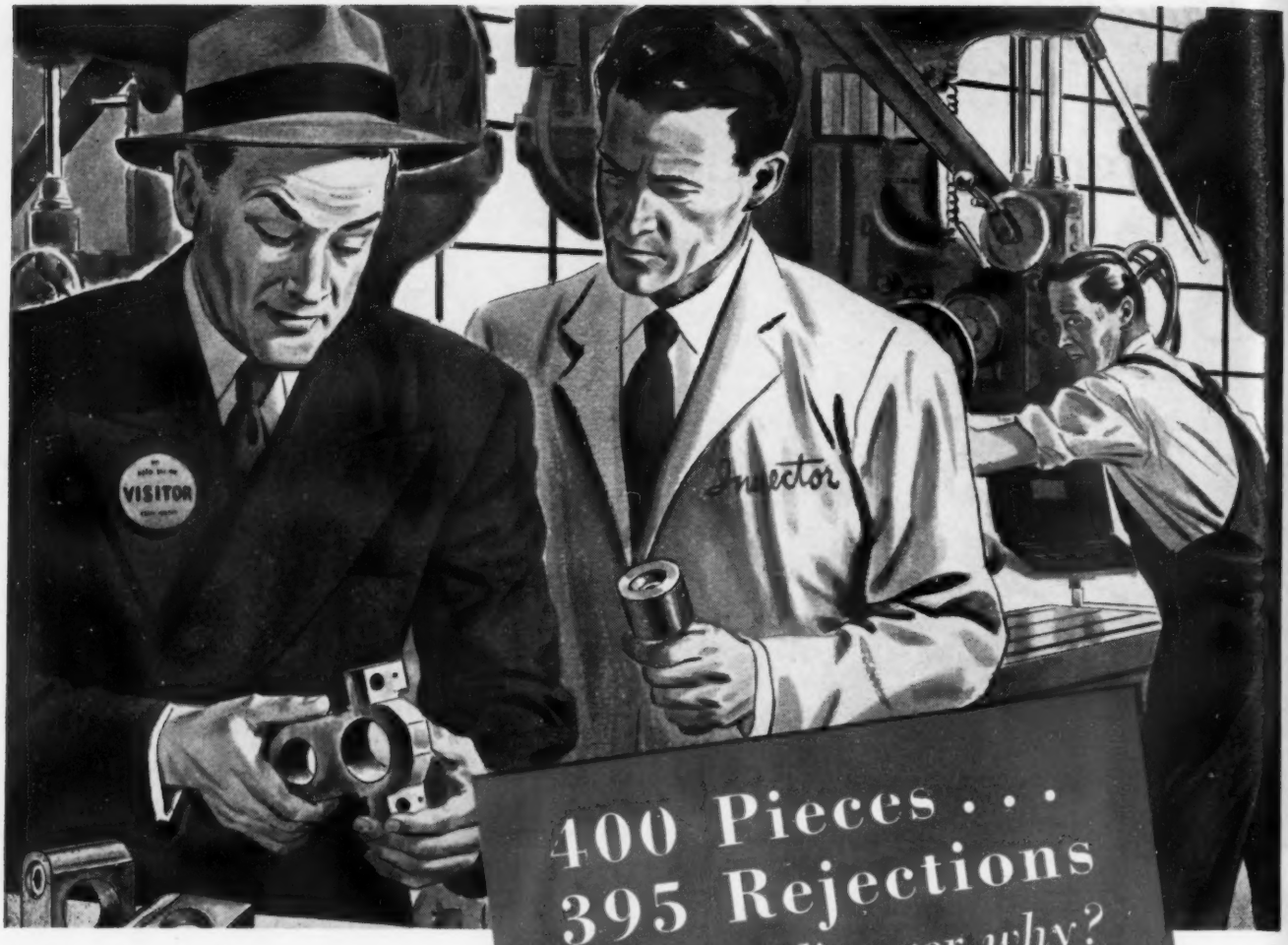
SNAP GAGES designed for ease in handling and speed in inspection. "STANDARD" Snap Gages are *standard* equipment for fast, precise war production. Constant analysis of materials and precision inspection at every stage of their manufacture insure the quality, stamina and accuracy of these *standard* "STANDARD" products.

SUPER *Snap Gages*

AN IMPROVED Snap Gage with spherical gaging pins that eliminate out-of-parallelism. Easily set, it requires no simultaneous adjustment to a given dimension and to parallelism. SUPER Snap Gage simplifies inspection, speeds production, insures greater accuracy and facilitates setting to closer tolerances. Write for special bulletin.

Complete Stocks Ready for Immediate Shipment

STANDARD GAGE CO., INC., *Poughkeepsie, N. Y.*



400 Pieces . . . 395 Rejections

Can you discover why? A P&W man did

THE SITUATION: a war plant was mass-producing precision parts on a Pratt & Whitney Jig Borer — a perfectly good practice, though the inbred accuracy of this tool makes it most commonly a toolroom machine. They had finished one job that was bored and counterbored from both sides. They inspected all holes at once with a fixture having mounted plugs. It was as tough a job as you could find anywhere, but every piece passed 100% . . . an amazing record. Yet the next job by the same operator on the same machine was a run of 400 pieces with *395 rejections* . . . equally amazing, but in the wrong direction.

Clues: the Pratt & Whitney field service engineer discovered that the two parts were generally similar, but that the first had a scraped surface to rest on and had square, solid shoulders, whereas the second had no scraped surface and was undercut. Further, the operator was green.

Problem: why the slip in accuracy?

You'll need only 5 seconds for this

Solution: that's right! You can't expect accuracy to "tenths" without a scraped surface as a base. Secondly, the undercut led the operator into the common error of springing the piece as he clamped it down. The P&W man recommended establishing an accurate base surface and the use of proper clamping. The job was then rerun quickly without trouble.

Busy as they are, Pratt & Whitney field engineers are always glad to help you solve precision-work problems. Remember this: *the accuracy is in the machine; use it right, and you can get it out.* Many helpful tips are in the instruction books that go along with every P&W machine. Have your *operators* study these books and learn the right way.

PRATT & WHITNEY
Division Niles-Bement-Pond Company
West Hartford, Connecticut

PRATT & WHITNEY

MACHINE TOOLS ★ SMALL TOOLS ★ GAGES

WEST HARTFORD CONNECTICUT

Basic Accuracy for Mass Production

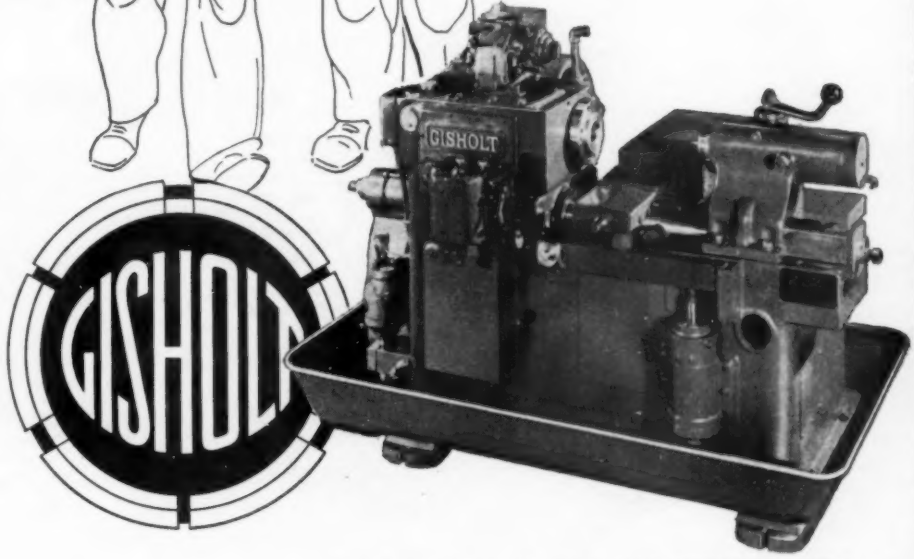
THE "VETERANS" HAVE JOINED UP

"Veterans" because of the long experience behind them . . . because of their ability to produce in large volume . . . . these Gisholt No. 12 Hydraulic Automatic Lathes are entering war production in greater numbers.

This is a case of effective wartime conversion by the McDonald Plant of the Continental Can Company. In peacetime, this plant builds can-making machinery. In war, its modern facilities have been contributing most effectively by producing these high speed automatic lathes. This lot of "veterans" is now on the job, turning out parts for vital equipment in unprecedented quantities.

GISHOLT MACHINE COMPANY
1201 East Washington Avenue, Madison, Wisconsin

Look Ahead . . . Keep Ahead . . .
With Gisholt Improvements in Metal Turning



THE GISHOLT No. 12 HYDRAULIC AUTOMATIC LATHE can out-produce two, three, or even four, manually operated machines. Yet, it is so simple to run that one man (or woman) can frequently tend several machines. Literature on request.

TURRET LATHES · AUTOMATIC LATHES · BALANCING MACHINES

Precision Threads-Faster!

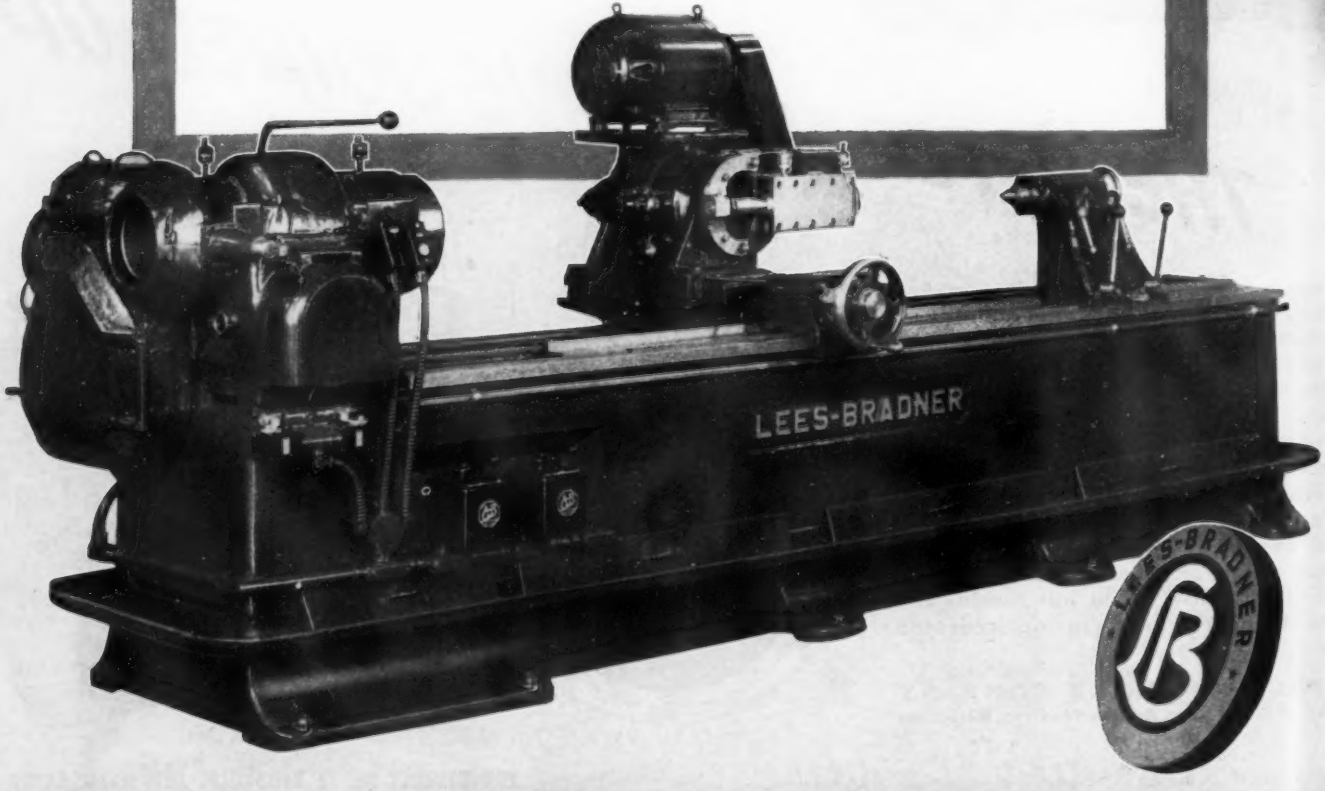
LEES-BRADNER

HT THREAD MILLER

● The sturdy, rugged construction of this machine not only permits feeds and speeds far in excess of previous practice but generates more precision threads faster on a wide range of work at unbelievably low costs.

It assures the utmost in accuracy on threads up to 2½" circular pitch and up to 12" diameter at production rates heretofore unattainable.

Why not consult Lees-Bradner engineers on your precision threading work where accuracy and high production is paramount.



The LEES-BRADNER *Company*

CLEVELAND, OHIO, U.S.A.

More Guns where they're needed

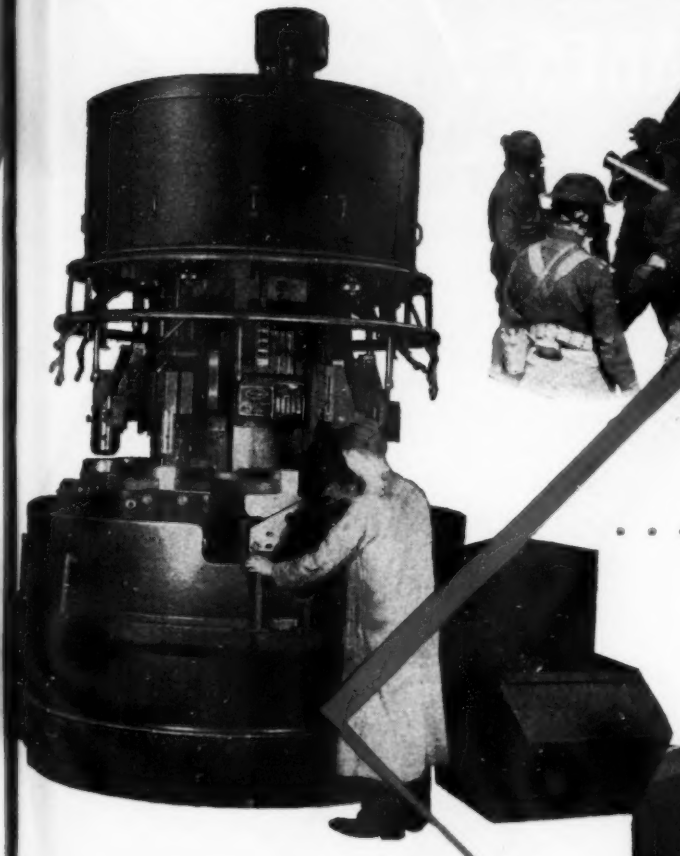
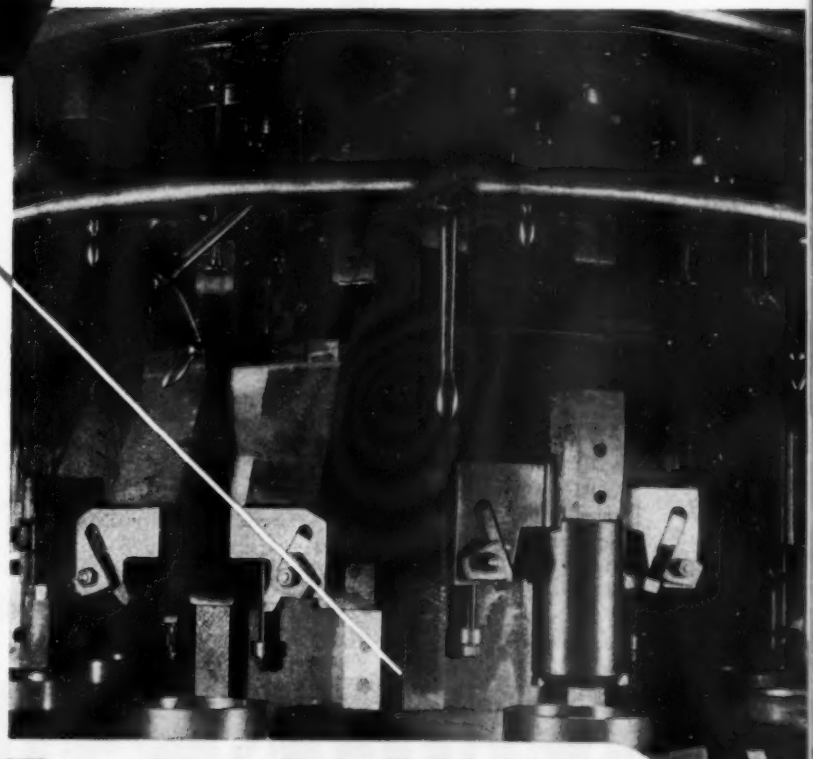


Photo by
U. S. Army Signal Corps

. . . because of breech rings made in half the time



• There's no substitute, at the front, for "more guns".

And one of America's plants is now shipping more guns—many more—since they put the breech ring job on 2 Mult-Au-Matics. Now the breech rings are ready for the assembly line in less than half the old time — completely bored, faced, turned, and finished!

Mult-Au-Matic accuracy contributes still further saving of time, by facilitating later operations. Production is constant, with no time out for maintenance or repairs.

Today, Mult-Au-Matic performance is speeding guns, tanks, planes in the numbers we need. Tomorrow, they will be instantly ready to speed your peace-time production.

THE BULLARD COMPANY

BRIDGEPORT, CONNECTICUT

Are You Having Trouble Getting SMALL THREAD PLUG GAGES...?

We have them!

Immediate Delivery from STOCK

SIZES
0-80
to 1"-8
National Fine
National Coarse
AND
Pipe Plug Gages
1/8 to 1 1/4

BY specializing in the manufacture of thread plug and ring gages, to the exclusion of all other types, the Cadillac Gage Company has built up an exceptionally large stock of standard thread plug gages, especially in the machine screw sizes. Orders and re-orders from the nation's leading armament manufacturers testify to the quality and accuracy of our products. Wire us your orders!

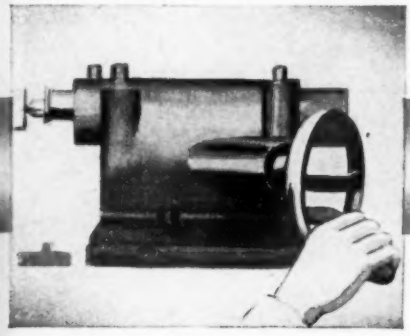
CADILLAC GAGE COMPANY
20316 HOOVER RD. DETROIT, MICH.

CADILLAC GAGE COMPANY
DETROIT

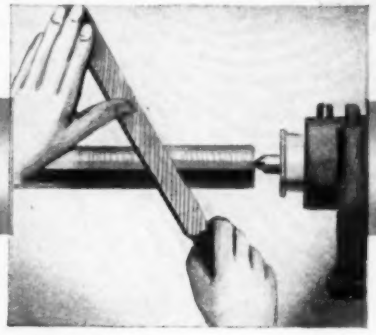
I'm Tellin' You . . .

No. 12 in a series on "Keeping 'em Turning" by Charles Carr, 37 years at LeBlond.

"We old-timers have been passing along the tips on 'Keeping 'em Turning' and we've given you about every important point in the book. But no matter how good a job of turning you've done, it's pretty tough to get a finish smooth enough to be used directly in service. You won't always have a grinding machine available and that's where filing and polishing come in. This is the way an old-timer does it . . . "

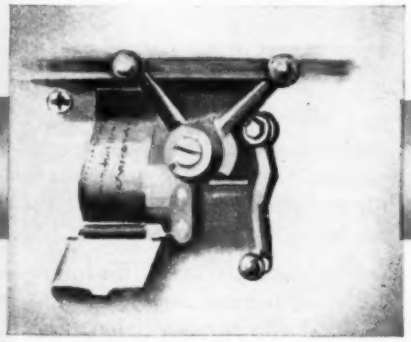


With work set up on headstock center, run tail center up tight, then slack off slightly and start lathe to run at twice finish turning speed, adjusting center to allow dog to click in face plate but not to allow rattle or end shake.

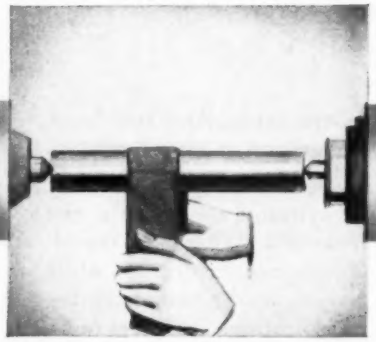


Use a 12-inch mill file with slow, even strokes, lapping from side to side. Use a long, slow forward stroke and press firmly and evenly on the revolving piece being filed. Relieve pressure on return stroke.

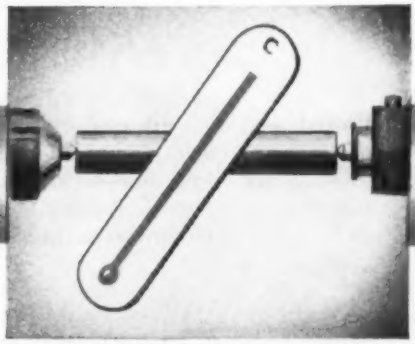
Stop lathe and try diameter with micrometer frequently until whole surface is filed as straight and smooth as possible. Leave from five to eight ten-thousandths (.0005 to .0008) of an inch for polishing the work.



For polishing work that is well-balanced, set change levers to give the highest possible speed. On unbalanced work, run the lathe at highest speed possible without vibration. A speed lathe is best for straight shafts one inch or less in diameter.



Use strip of emery or carborundum paper of fine grade and press against work, moving abrasive cloth from side to side to cross lines and bring work to rough polish without cutting rings. Use very fine abrasive cloth and oil on work for final polish.



Watch out for heat! Remember, polishing and filing heat the work. When measuring with a micrometer, either cool the work by immersing in water or else make an allowance of one or two ten-thousandths of an inch for cooling of work.

ARMY E NAVY

THE R. K. LeBLOND MACHINE TOOL CO.

Cincinnati, Ohio

Largest Manufacturer of a Complete Line of Lathes

DEATH LEAVES A FINGERPRINT

Probably it was hot and humid in the assembly room... that day when warm, perspiring fingers accidentally touched a tiny, needle-pointed shaft. But the fingerprint remained... acid, corrosive...

A saboteur—this accidental fingerprint? Yes—for on a later day that tiny part, weakened by corrosion, may fail—in a submarine depth-gauge, an airplane altimeter, or in any of scores of delicate military instruments. And just because of a fingerprint, a man may die.

* * *

ANOTHER WAR JOB FOR AIR CONDITIONING. Where precision instruments are made, on which men's lives depend, air conditioning reduces perspiration . . . filters out dust . . . helps speed output.

And this is but one example of how General Electric *air conditioning* and *industrial refrigeration* may serve the war effort. To meet the exacting requirements of these wartime applications, General Electric is producing equipment that is highly efficient . . . flexible . . . compact.

When peace comes, this improved air conditioning equipment — by General Electric—will be available to all.

General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Division 436, Bloomfield, N. J.

Air Conditioning by

GENERAL ELECTRIC

CYLINDRICAL PLUG AND RING GAGES

METRO PLUG AND RING GAGES ARE MANUFACTURED IN ACCORDANCE WITH AGD STANDARDS

4 Kinds

NEW CHROME New gages finished with LONG LIFE Hard chrome plating.

NEW STEEL New gages of Hardened steel.

SALVAGE . . . Worn gages refinished with LONG LIFE Hard chrome plating.

CARBIDE New gages with EXTRA LONG gaging life.

ALL GAGES PRECISION LAPPED

SPECIAL GAGES TO ORDER

Catalog No. 101

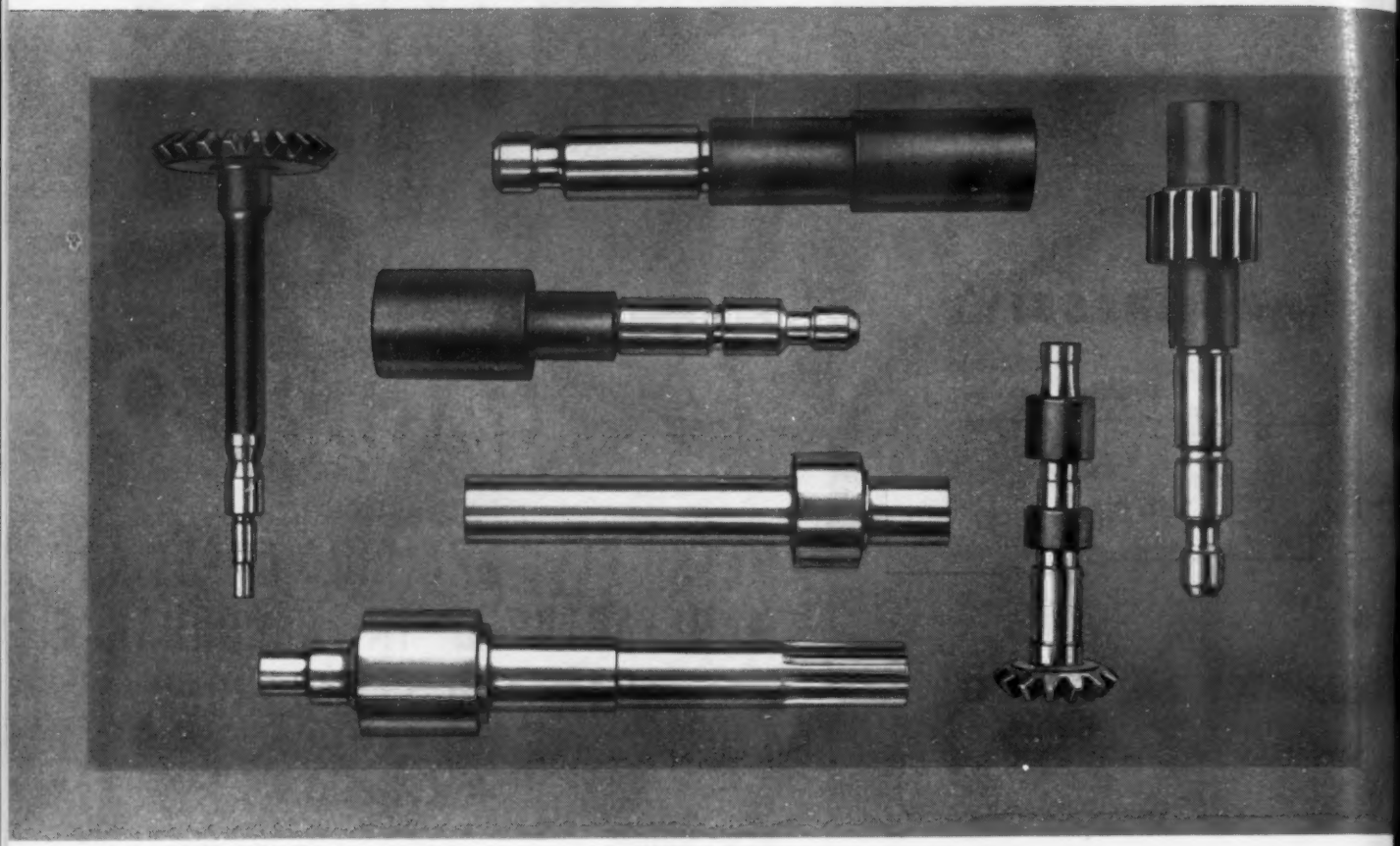
gives complete details on all METRO TOOLS and GAGES. Get your copy now.

METRO TOOL AND GAGE CO.

4240 PETERSON AVE.
CHICAGO, 30, ILL.

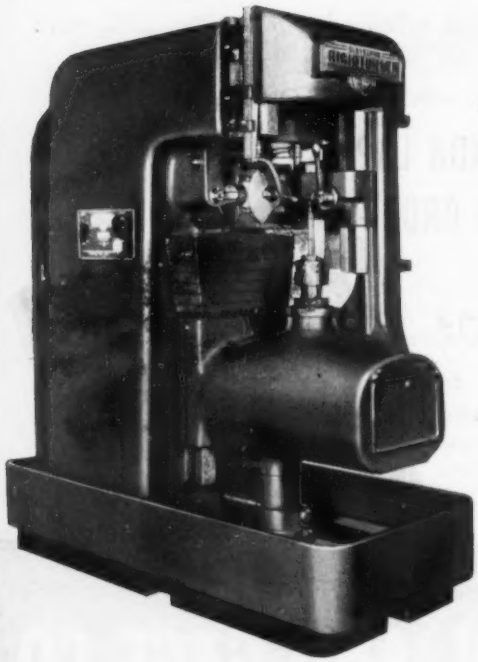
ARE YOU TURNING PIECES LIKE THESE?

(Either Small Lots or High Production)



Then you should investigate the RIGIDTURNER

The NEWEST thing in Multiple Diameter Turning



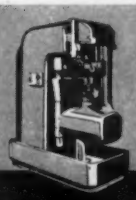
New—in that it presents a radically different method of producing multiple diameters—accurately—faithfully—in quantity

Here's what happens on the Rigidturner, the work advances past the cutter which is rotated in variable timed relation producing various diameters.

Machine operation is automatic—operator merely loads machine, presses button and machine does the work. Investigate this modern method of accurate duplication of multiple diameters.

Write for this booklet

Write for this full descriptive booklet showing the many advantages of the Rigidturner—in accuracy—in high production—in low cost operation. No obligation.



The CLEVELAND HOBBING

Cleveland ... MACHINE Company ... Ohio

BUILDERS OF RIGIDHOBBERS AND RIGIDTURNERS

Van Keuren

OPTICAL FLATS

THE PROOF OF PRECISION IN AMERICAN INDUSTRY SINCE 1920 . . .

How do you check the accuracy of your precision gage blocks?

How do you maintain accuracy on your measuring equipment?

How do you test the flatness of precision lapped parts?

The Van Keuren Light Wave Measuring Equipment illustrated above measures millionths of an inch, and is a fundamental requirement in plants where precision is maintained. The equipment consists of three semi-quartz master flats, one steel flat and a monochromatic light. The monochromatic light shows clear and distinct light wave bands which have a known measuring value of 11.6 millionths per dark band. Straight bands indicate a flat surface and curved bands show a convex or a concave surface. Be sure to specify a Van Keuren Light Wave Measuring Equipment with completed instructions for your inspection work.

Van Keuren optical flats are the ultimate of precision. Single flats and optical parallels are available in 1¼", 2", 3", 4" and 6" diameters in both master and working grades. Special flats are made on order. Optical flats are easy to use. Complete instructions on "How to Use Light Waves" are furnished with all Van Keuren optical flats.

DETECTING A WORN SPOT ON AN AMPLIFYING GAGE ANVIL

The light wave interference bands dip an amount equal to twice the distance between adjacent bands, showing a valley 2 bands (or 23 millionths) deep.

The Van Keuren Manual of Precision Measuring Tools gives complete specifications and prices on optical flats. Write for your copy.

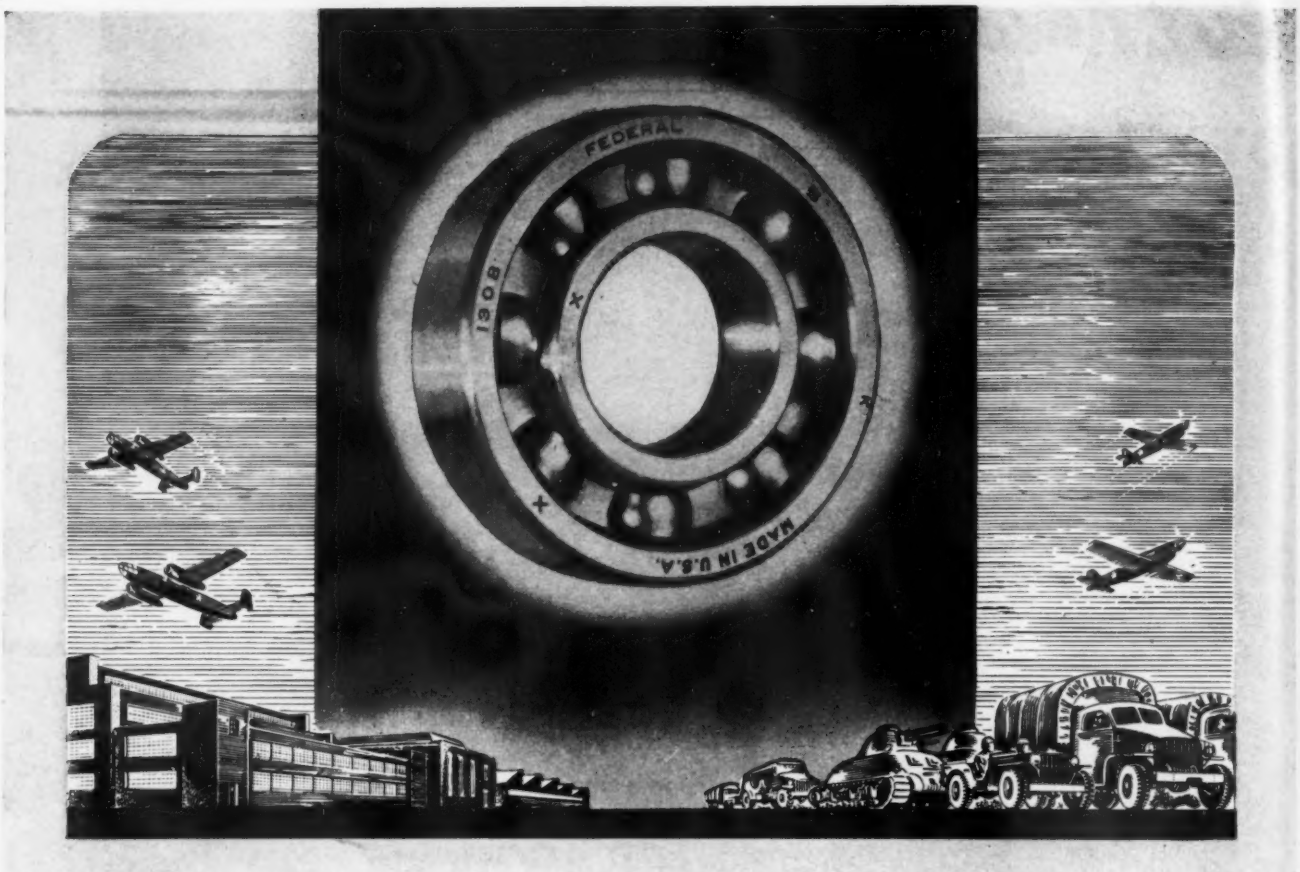
Van Keuren

THE CO., 176 WALTHAM ST., WATERTOWN, MASS.

24th YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages

Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles



FEDERAL
BEARINGS

TRADE MARK

Federal is doing an outstanding job—in war production, in industry and in Uncle Sam's mechanized vehicles at home and abroad . . .

For the duration we are unable to supply many types of bearings formerly manufactured

THE FEDERAL BEARINGS CO., INC.

Makers of Fine Ball Bearings

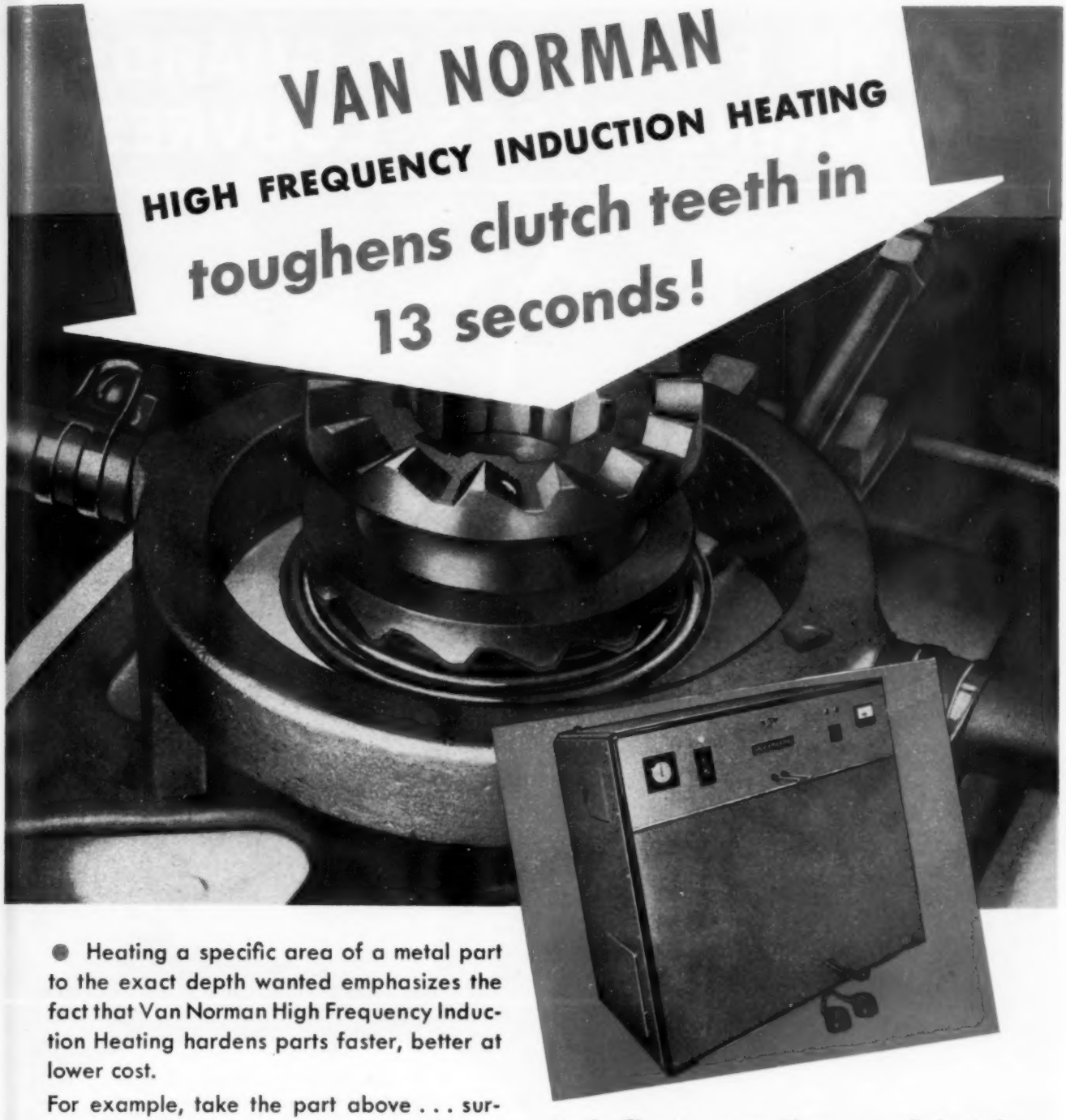
U. S. A.

REPRESENTATIVES LOCATED AT

Detroit: 2640 Book Tower • Cleveland: 402 Swetland Building
Chicago: 902 S. Wabash Ave. • Los Angeles: 5410 Wilshire Blvd.

VAN NORMAN

HIGH FREQUENCY INDUCTION HEATING toughens clutch teeth in 13 seconds!



● Heating a specific area of a metal part to the exact depth wanted emphasizes the fact that Van Norman High Frequency Induction Heating hardens parts faster, better at lower cost.

For example, take the part above . . . surface hardening clutch teeth. Van Norman Induction Heating hardens the teeth to 58 Rockwell C, to a depth of $^{3}/_{64}$" in 13 seconds . . . at a current cost of only 1 cent. Note how uniformly the heating pattern, as revealed by the tooth surfaces, closely follows the contour of the clutch teeth. Cleaning operations are eliminated and each finished part is identical.

Get the story on *Van Normanizing*, today. Find out how Van Norman High Frequency Induction Heating speeds output and lowers cost in Hardening, Brazing, Soldering, Annealing, and other heating applications.

VAN NORMAN MACHINE TOOL CO.

SPRINGFIELD, MASSACHUSETTS

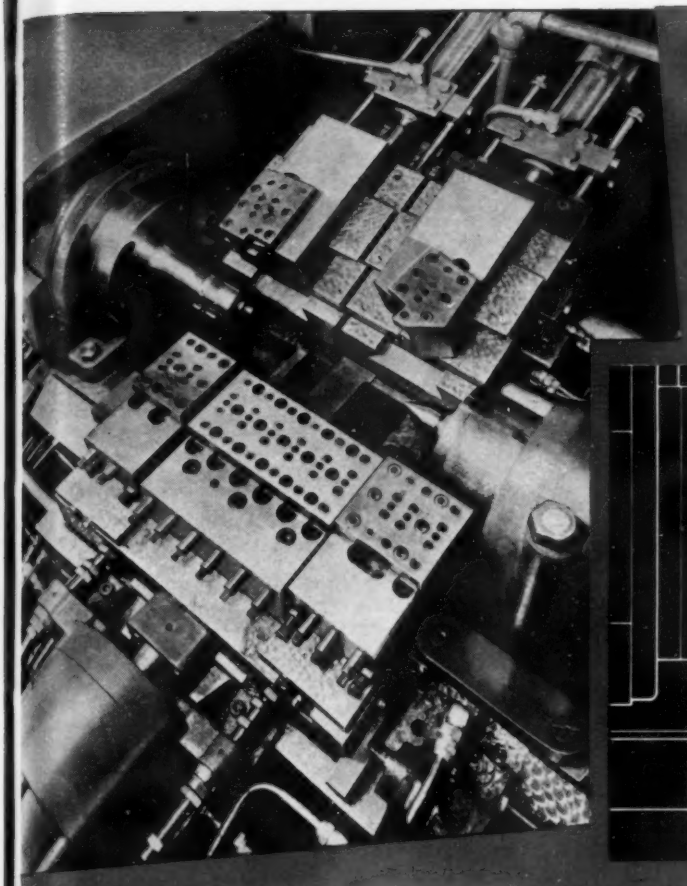
"It pays to Van Normanize"

LATHE PANS, GEAR GUARDS, MACHINE BASES, LOUVRES

If you need fabricated plate and sheet steel products such as Lathe Pans, Gear Guards, Machine Bases, Louvres for Covers, Housings, etc., send your blueprints to Littleford Bros., Inc. for prices. Our modern plant and skilled workmen can produce such units at a very low cost. Over 60 years' fabricating experience is your guarantee of quality products. Don't delay your production, act today.

LITTLEFORD

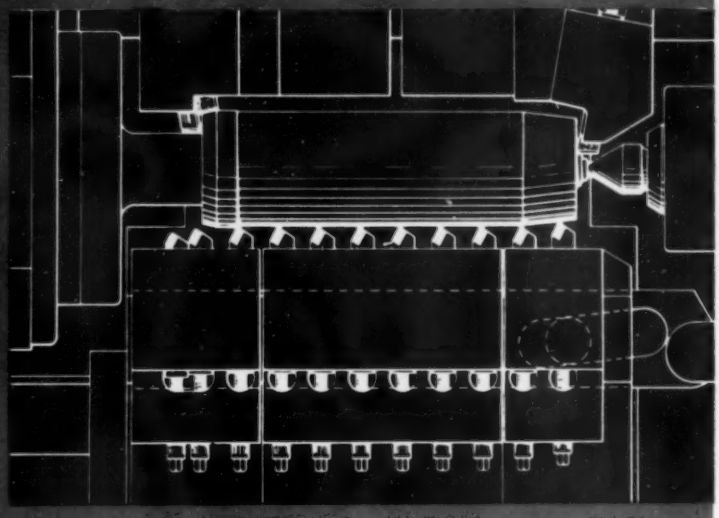
LITTLEFORD BROS., INC.
434 E. Pearl St. Cincinnati, Ohio



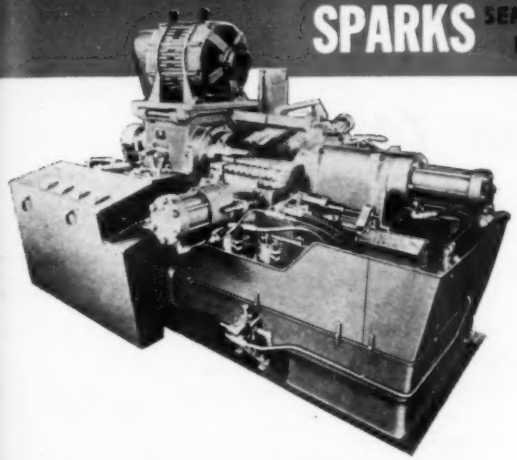
MULTIPLE TOOLING

HYDRAULIC CONTROL

CUTTING TIME: 30 SECONDS



SPARKS SEMI-AUTOMATIC HYDRA-FEED MASS PRODUCTION LATHE



TOOLING FOR ROUGH TURNING 4.7" SHELL

Length of Shell: 16⅛"

Front Tool Travel: 1 13/16"

Number of Tools: 14

OPERATIONS: Rough turning boat-tail, body diameters and nose end (removing flange from nose end) handled by 11 front tools. The two right hand front tools are cam controlled for turning boat-tail taper. Facing base, facing nose end and cutting bevel on nose end—each job handled by one of the 3 back tools.

Pieces per tool grind: From 200 to 250 when using carbide tipped tools.

Average cutting time: 30 sec. approximately.

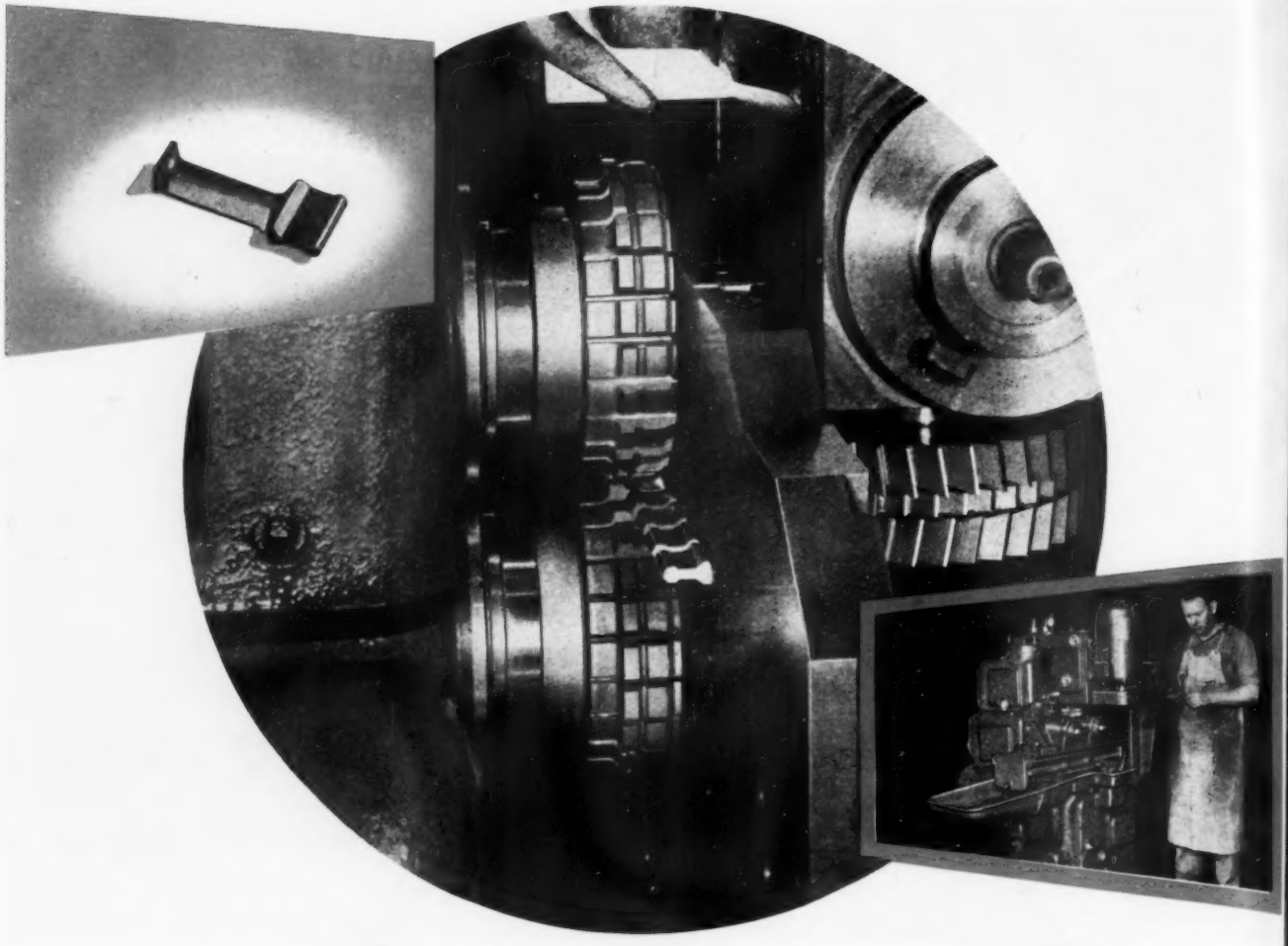
Adaptability of the SPARKS HYDRA-FEED LATHE to multiple tooling set-ups makes it possible to attain remarkably fast production on a wide variety of work. The job shown here—that of rough turning 4.7 shell—is but one of many where mass production has been attained on a manufacturing lathe with minimum effort on the part of the operator. Ability to make outstanding savings in time and manpower, especially when these two factors are of such vital importance in today's production, puts high value on the contributions made by SPARKS engineers to the war effort.

The actual example shown here is typical of others made available through SPARKS multiple tooling possibilities.

The SPARKS HYDRA-FEED LATHE is so designed that the tooling set-up for a particular job can be dis-assembled and a newly designed set-up for a different piece of work substituted. The extent of change-over involved from one tooling set-up to another depends on the degree of difference between the work pieces. A study of SPARKS bulletins (available on request) will disclose the wide variety of work for which these fast, powerful, mass production machines are adaptable.

SPARKS HYDRA-FEED LATHE

SPARKS MACHINE TOOL CORPORATION
NORWALK . . . . CONN.



with B-C *Holding Form to .00025"* UNGROUND FORMED CUTTERS

THIS piece for a vital part of war machinery is being successfully produced in large quantities with an *unusually fine finish.* Three milling operations in all are performed in finishing the tough steel forging. The second operation, shown above, consists of forming the radius and neck on one end of the piece and at the same time sizing to length and width on the other end. For the forming operation, two B-C UNGROUND Formed Milling Cutters are used, running on parallel spindles as shown. These cutters are large in diameter and have a large number of gashes to produce the fine finish which is essential and they hold the radius in relation to the neck *within .00025".* The sizing is accomplished by a combination of two B-C Half Side Milling Cutters and a Plain Milling Cutter, all ganged on a vertical spindle on the opposite side of the work holding clamp. These B-C cutters were *specially designed for this job* by experienced B-C small tool engineers and their outstanding performance is full testimony of our engineering department's ability to design Better Cutters. You, too, can profit from this engineering service by taking your cutter problems to your Barber-Colman representative, or by sending the data directly to us.

PRODUCTION DATA

Material — Tough Steel, Work Hardens.
Feed — 1 inch.
Cutter Speed — 48 R.P.M.
Stock Removal—Width .035" Each Side. Depth 7/8" Each Side.
Machine — Sundstrand No. 1 Rigidmil. Three Spindle Head.
Holding Means — Special Fixtures.
Production — 59 pieces per hour, 1 machine.
Pieces per Cutter Sharpening — 2,000.
Production with former method — 80 per hour on two machines.

CUTTING TOOLS ARE SCARCE
MACHINES CAN'T RUN WITHOUT THEM
CONSERVE WHAT YOU HAVE

Buy War Bonds

BARBER B-C COLMAN PRODUCTS
HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

Barber-Colman Company

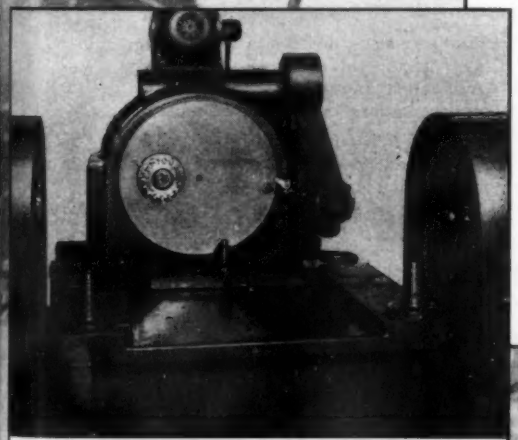
GENERAL OFFICES AND PLANT • 201 LOOMIS STREET • ROCKFORD, ILLINOIS, U. S. A.

Conserve Man Power today...

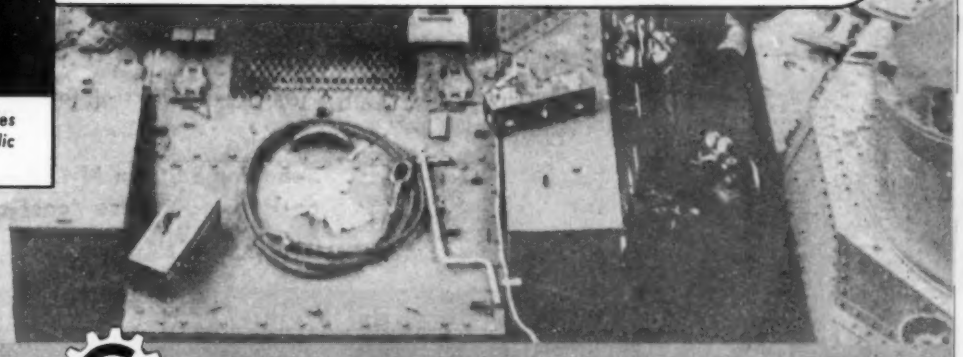
WITH CROSS SPECIAL MACHINES

CROSS 3 WAY *Milling Machine*

Demand for greater volume cannot be satisfied with the lone expedient of additional man hours. Manufacturers who were forced to improvise for a quick start are now increasing production with special machines that consolidate many operations. Cross analyzes manufacturing problems, develops new methods, engineers and produces special machines for doing better work faster. A typical application: the Cross 3-way profile miller which simultaneously finishes three faces on tank transmission housings with improved accuracy and saves 6 man hours per piece.



Cutter spindles are mounted in large circular cradles that oscillate in synchronized relation with hydraulic cross feed of the heads.



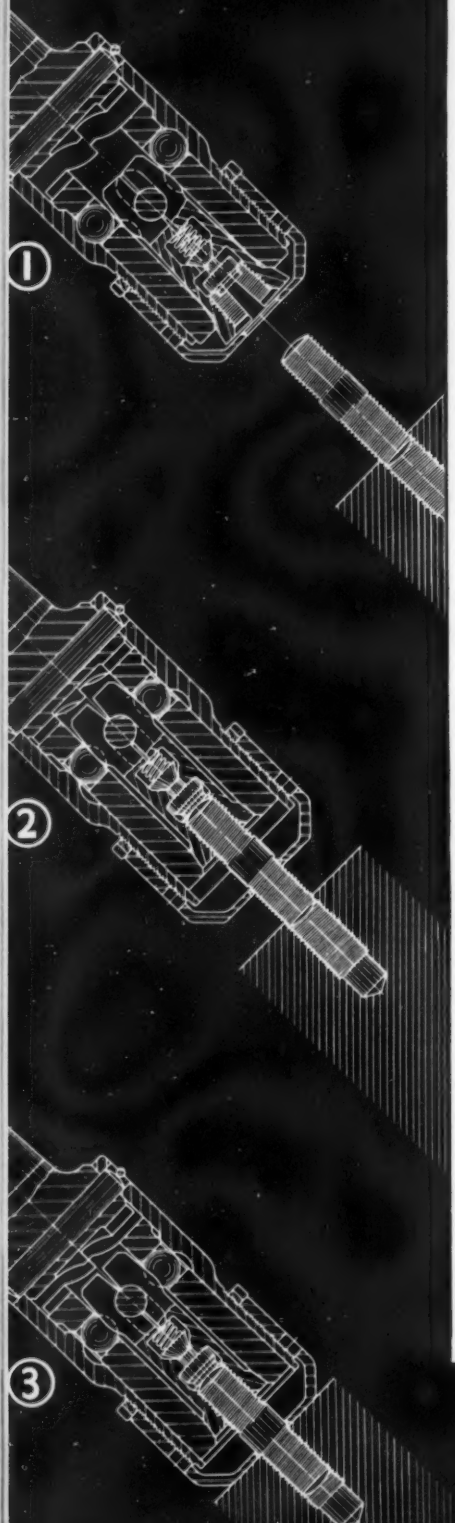
FROM PRESS ASSOCIATION, INC.

CROSS GEAR & MACHINE CO.

Established in 1898

DETROIT, MICHIGAN, U.S.A.

Here's Your Answer to Maximum Stud-setting Speed and Economy



MODERN
SELF-OPENING STUD SETTERS

Make the most of your manpower! Keep your production *up* with Modern Stud Setters—the fastest tools of their kind yet developed.

If you are finding the maintenance of production schedules difficult, these stud-setters can help you greatly. Their terrific speed not only enables fewer men to do the same amount of work but cuts your stud-setting costs as well.

Modern Self-opening Stud Setters have a real dollar-and-cents message for *you*. Do your stud-setting the Modern way.

OPERATION IS SIMPLE, AUTOMATIC, POSITIVE!

The great speed with which this tool operates is due to its simple, automatic, positive action. To understand this action is to know why shops everywhere depend on Modern Stud Setters.

The three drawings at the left show the three steps in Modern stud-setting. 1. Jaws are open to take studs. Clutch is not yet engaged. 2. Driving position with jaws locked on stud and clutch engaged. 3. Stud driven to full depth. Stop collar contacts work, releases clutch and the act of lifting the tool opens the jaws.

Thus you get continuous action. The tool revolves in *one direction only*. There *is no reversing and no stopping*. As a result the operator can set studs almost as fast as he can move from one to another.

Time and Labor Saving Features:

Does not mutilate threads.
Drive can be stopped at any point and jaws opened.
Ball locking device prevents jaws opening until stud is set.
Rectangular grip relieves jaws of torsional strain.
Rugged construction minimizes danger of failure.
Easy, quick removal of broken studs.
Easily, quickly taken apart—Fourteen parts.
May be operated in any position.
May be adjusted for any height stud.

Send for Bulletin M-186 which gives full details concerning these cost-cutting stud setters.

CONSOLIDATED MACHINE TOOL CORPORATION

MODERN TOOL WORKS

DIVISION

ROCHESTER, NEW YORK

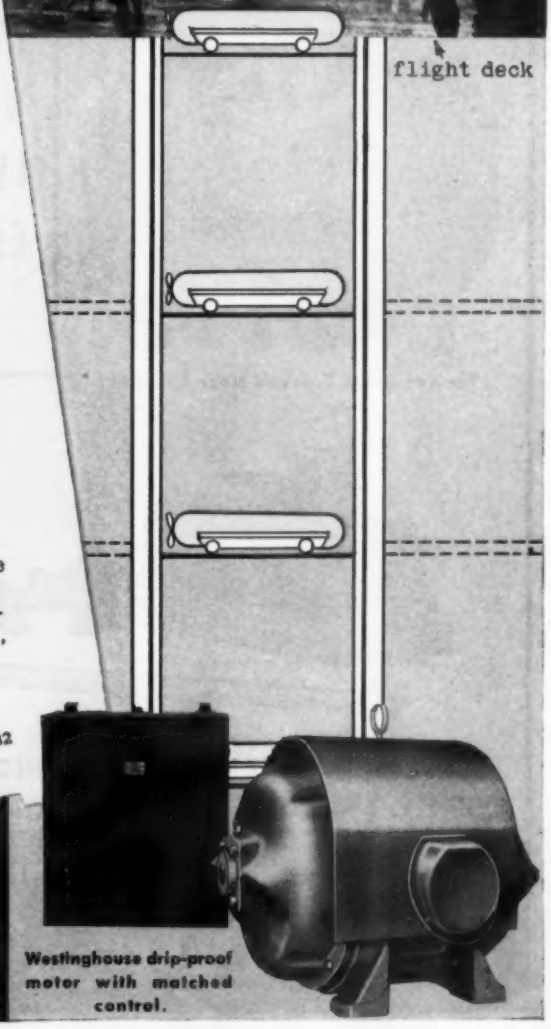
Delivering "FRESH FISH" . . gently . . for Axis breakfasts

"On the alert"—men, machines, and torpedoes function smoothly as one team on board this aircraft carrier. From the depths of the ship a fast-moving elevator lifts a load of deadly "tin fish", bringing its platform to a smooth stop within 1/16-inch of the deck. An important 1/16-inch, because it permits torpedoes to roll directly onto the flight deck without dangerous jarring—or extra, time-consuming handling.

The motor and control which power the elevator work as a team—lifting torpedoes at high speed to the deck and then slowing down gently to a stop "on the nose". To do this, the motor was built with two windings: a high-speed winding for lifting or lowering, and a slow-speed winding for leveling to an accurate stop.

Westinghouse builds many ratings of motors and controls for military and war industry applications. A multitude of these units, like the Westinghouse motor and controls in this elevator, are constructed to withstand the shock and pounding of sea and air battles. For any type of motor, any control . . . on any application . . . call your nearest Westinghouse office.

J-21282



Westinghouse drip-proof motor with matched control.

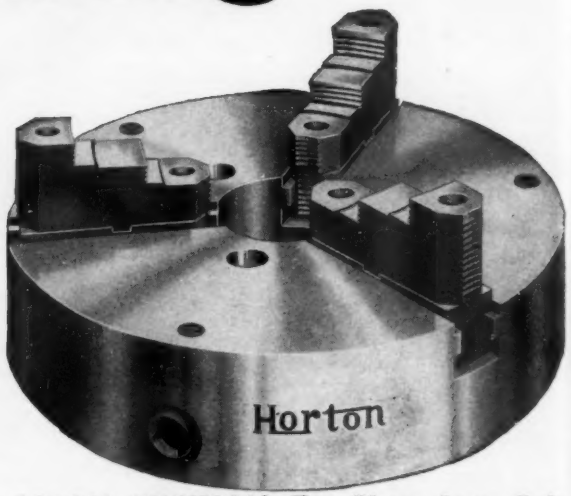
Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

MOTORS AND CONTROL

Horton chucks

INDEPENDENT Solid Reversible Jaws Only

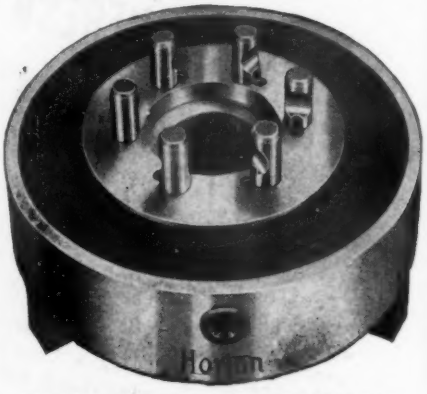


SCROLL UNIVERSAL Two-Piece Jaws Only

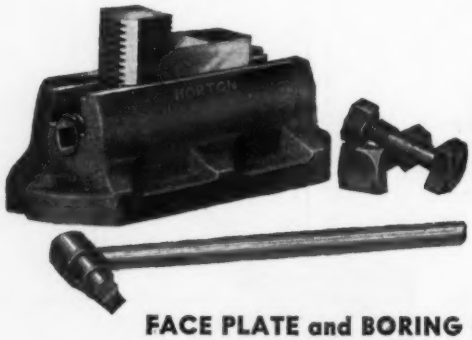
For Use With Intermediate Plates On Threaded Spindles

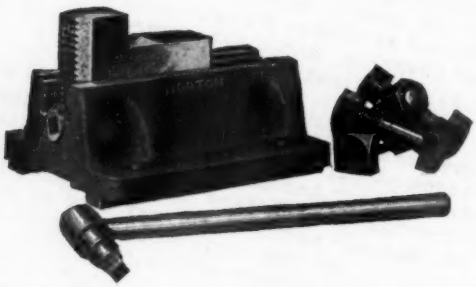
For Key Drive Tapered Nose Spindles

War Production Limited To These Essential Chucks



For Flanged Tapered Nose Spindles
Illustration shows Chuck for Type D (Cam Lock) Spindle





FACE PLATE and BORING MILL JAWS—Steel Body Only

HORTON MORROW

SINCE 1851 .... THE E. HORTON & SON CO.
WINDSOR LOCKS, CONNECTICUT, U. S. A.

Harness
FOR PEGASUS

Pegasus, winged horse of ancient mythology, has long represented the free flights of fancy indulged by poets and dreamers. But Pegasus finds himself in harness now — a practical, workaday harness, indeed.

Engineers and designers everywhere have permitted themselves to dream as never before, yet ways have been found to make those flights of fancy carry real pay loads. Clearing presses are producing parts for some amazing products — often by procedures which only yesterday would have been called impossible.

Clearing ingenuity, skill and facilities, and Clearing experience are at your service as you plan your products for a future market. Whatever the shape of things to come from your plant, whatever their materials, Clearing presses can probably help you to faster, lower cost production. Let us help you fashion a harness for your own Pegasus.

CLEARING MACHINE CORPORATION
6499 W. 65th Street, Chicago, Illinois

The forming of Venturi rings for engine cowling assemblies is one of the jobs assigned to this double action 350-ton capacity Clearing Mechanical Press—installed at one of the plants of the Douglas Aircraft Company, Inc.

CMC
CLEARING

FOR SHAPES OF THINGS TO COME

CLEARING
MECHANICAL AND HYDRAULIC PRESSES

CLEVELAND SINGLE CRANK PRESSES

WITH *automatic dial feed*

13 S Single Crank, Single End Drive equipped with 8 station dial feed for the production of 37 mm shell cases, 10" Stroke 150 tons capacity.

14 S Single Crank, Twin Drive, equipped with 8 station dial feed for the production of 37 mm Shell cases, 18" stroke 180 tons capacity.

14 S Single Crank, Twin Drive, equipped with 8 station dial feed for the production of 40 mm shell cases, 32" stroke, 180 tons capacity.

• Cleveland Straight Sided Single Crank Presses can be furnished in a wide range of sizes with capacities ranging from 60 to 1300 tons.

While the Presses illustrated are equipped with automatic dial feeds for the production of steel shell cases, this type of Press can be used for a great many standard operations which are essential to both war time and peace time requirements such as: blanking, punching, stamping, forming, drawing, sizing and light embossing.

Complete information on this, or any of the other twelve different types of Cleveland Presses, will be gladly furnished on request.

THE CLEVELAND PUNCH & SHEAR WK'S CO. U.S.A.

THE CLEVELAND PUNCH & SHEAR WORKS CO CLEVELAND · OHIO

UNION

For Wartime Tool Economy

Present conditions make it vitally important that maximum service be obtained from every small tool. One of the first steps toward tool economy is to choose tools that are known for their ruggedness and longer lasting accuracy.

Choose UNION Tools—treat them well—and you will see the results of your economy in the longer accurate service and uninterrupted production you get from every tool bearing the UNION name.

UNION TWIST DRILL CO.

ATHOL, MASS.

S. W. Card Mfg. Co. Div., Mansfield, Mass.
Butterfield Div., Derby Line, Vt.
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Divisions of the UNION TWIST DRILL CO.

UNION BUTTERFIELD CARD

THE Right REAMER FOR EVERY WARTIME JOB

Butterfield

Today's problem is to combine maximum efficiency and unquestioned accuracy in the production of parts for ships, guns, tanks, shells and planes. In plants where war production records are being set, Butterfield Reamers are turning out work that meets rigid standards of precision and, at the same time, demonstrating their ability to give long, economical service. The completeness and the uniformity of the Butterfield line make it possible to choose the "one best" tool for every job from this single convenient source of supply.

Divisions of the
UNION TWIST DRILL CO.

BUTTERFIELD DIVISION
DERBY LINE, VT. **ROCK ISLAND, QUE.**

STORES: New York, 61 Reade St. Chicago: 11 So. Clinton St. Cleveland, Hal. W. Reynolds, 3346 Superior Ave. Detroit, 6540 Antoine St. Los Angeles, 524 E. Fourth St. Toronto, 137 Wellington St., West. Montreal, 111 St. Paul St., West. Winnipeg, 403 Travellers Bldg. Vancouver, 327 Shelly Bldg. Agents for Great Britain—Charles Churchill & Co., Ltd., 27-34 Walnut Tree Walk, Kennington, London, S.E. 11, England. Branches at Birmingham, Manchester, Glasgow, Newcastle-on-Tyne and Bristol.

UNION BUTTERFIELD CARD

A PRECISION PRODUCT . . . A LIFETIME OF PRACTICAL EXPERIENCE

For over 65 years, we have been making Card Taps for precision applications in every industry. Today, more than ever before, higher standards of accuracy, tougher, harder materials and increased production schedules call for superior tools. For your war production needs, choose your taps from the complete line made by the Card organization of tap experts . . . and get the added value of our lifetime of knowledge of every angle of tap use.

S. W. CARD MFG. CO.
MANSFIELD, MASS.

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New York: 61 Reade St.
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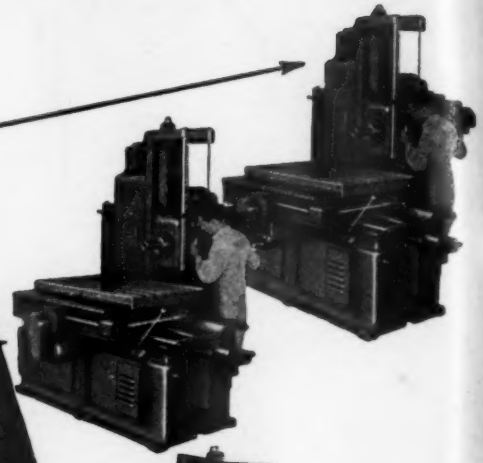
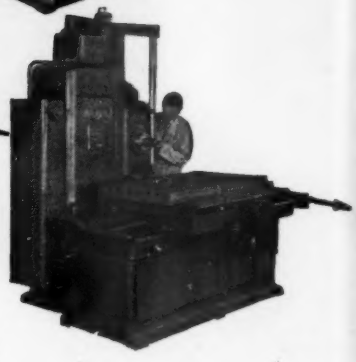
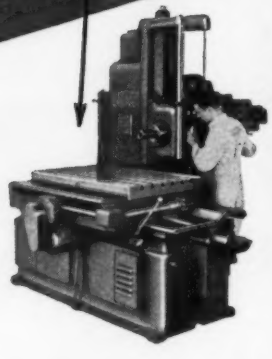
UNION BUTTERFIELD CARD

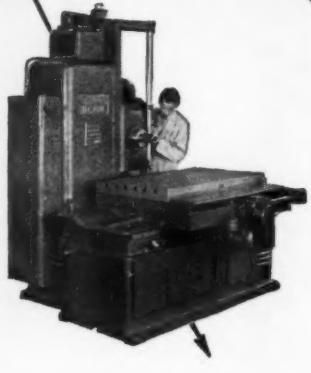
FAR EASIER OPERATOR TRAINING

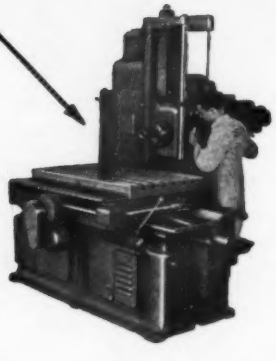
—experience of a hundred users of the DEVLIEG JIGMIL











Experience of more than a hundred users of the DeVlieg Jigmil has proved that operator training is far easier with this machine—because the Jigmil has built in features of quality that do not require a compromise with operator skill to produce accurate work in high production.

Every frequently used function of the machine is controlled in the master switch on the spindle head—at the operator's fingertips. These include:

Spindle start, stop and reverse.

Power vertical feed and rapid traverse movement.

Power horizontal feed and rapid traverse movement.

Power automatic table retraction and repositioning.

Power feed and rapid traverse to bar movement.

The operator never has to take his eyes off the work—never has to look at controls during operation. The machine is so convenient it gives greatly simplified response to the operator's skill.

An operator learns rapidly—frequently reaches full production of high quality in a week or two.

NEW TYPE MACHINE

Spacing accuracy of a jig borer . . . performance qualities of a milling machine . . . convenience and flexibility of a horizontal boring mill.

New speed of operation—many machines show 75% greater average daily productivity.

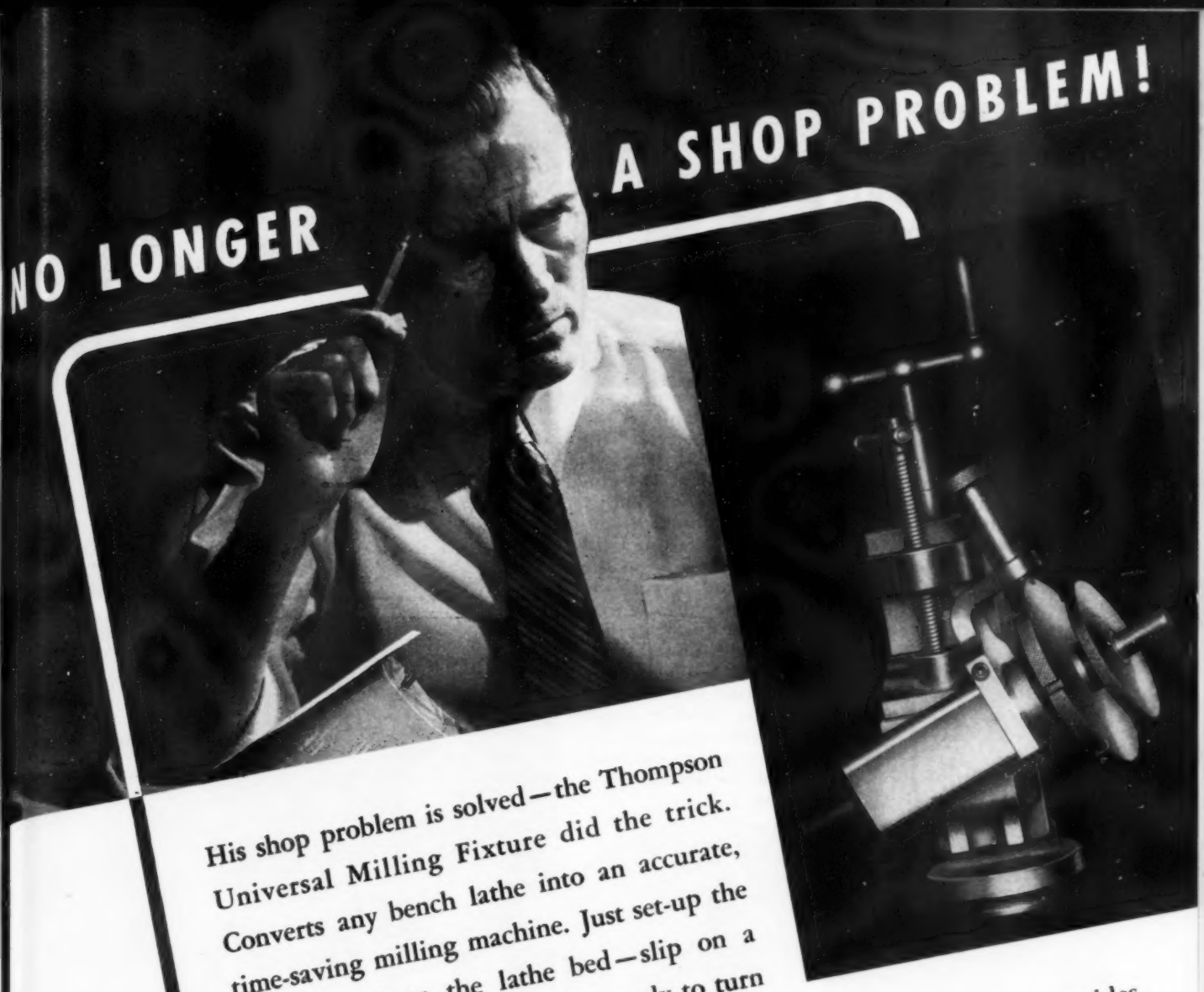
Write for Circular

DE VLIEG MACHINE COMPANY

450 FAIR AVE. FERNDALE (DETROIT) MICHIGAN

DEVLIEG MACHINE TOOLS

NO LONGER A SHOP PROBLEM!



His shop problem is solved—the Thompson Universal Milling Fixture did the trick. Converts any bench lathe into an accurate, time-saving milling machine. Just set-up the "Thompson" on the lathe bed—slip on a stock index plate—and you're ready to turn out indexed work, fast, with no chance for error—the indexing is fool-proof. And the 3-way circular swing provides exceptional maneuverability—produces a wide variety of end mills, reamers, splines, punches and special cutters. Flat stock may be milled plain, straight or angular, by using the vise without the indexing unit. *Write for further information.*

ARMY E NAVY

Awarded to Auto-Ordnance Corporation for excellence in production of "Tommy" Guns.

TRADE-MARK
Thompson
REG. U.S. PAT. OFF.

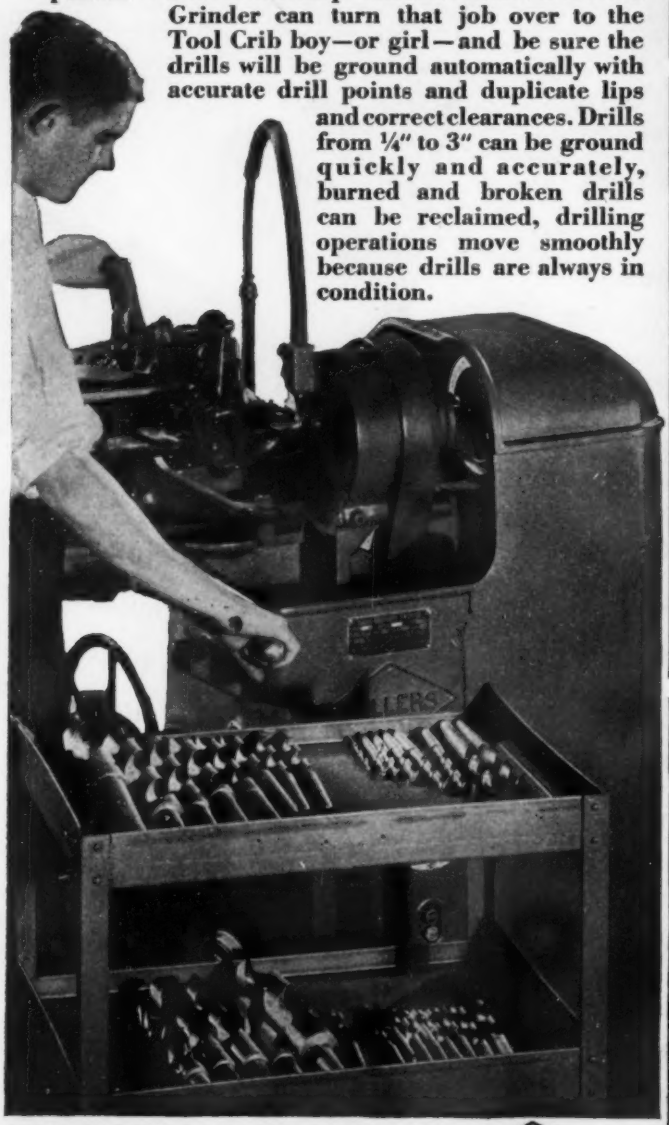
AUTO-ORDNANCE *Corporation*

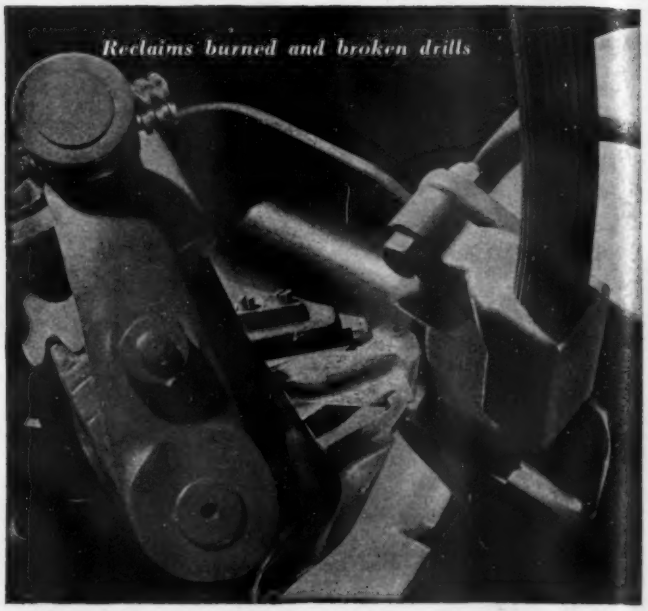
THOMPSON TOOL DIVISION

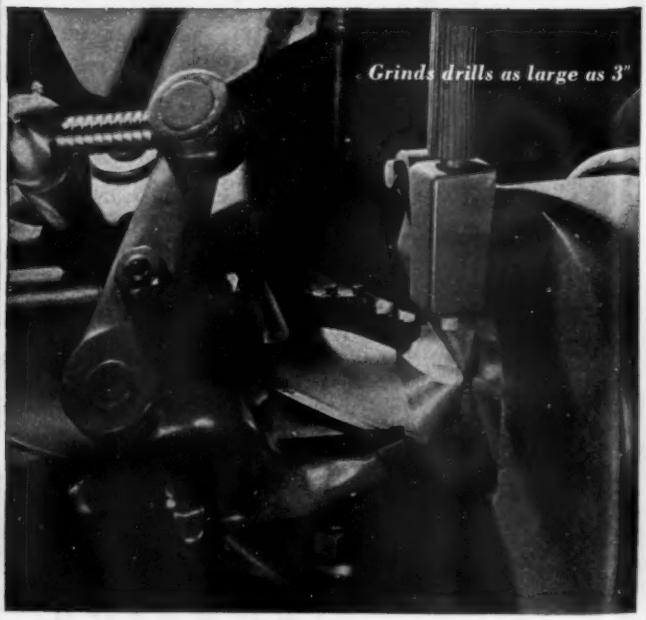
342 WEST PUTNAM AVENUE, GREENWICH, CONN.

The SELLERS Model 6-G Drill Grinder is Ideally Suited to Present Day Operating Conditions

AUTOMATIC!—that is one feature that makes the Sellers Drill Grinder invaluable today. With inexperienced, newly-trained operators, drill grinding can no longer depend on the skill of the old-time machinist who prided himself on his ability to grind tools. The machinist is busy on more important work. So the shop with the Sellers 6-G Drill Grinder can turn that job over to the Tool Crib boy—or girl—and be sure the drills will be ground automatically with accurate drill points and duplicate lips and correct clearances. Drills from ¼" to 3" can be ground quickly and accurately, burned and broken drills can be reclaimed, drilling operations move smoothly because drills are always in condition.





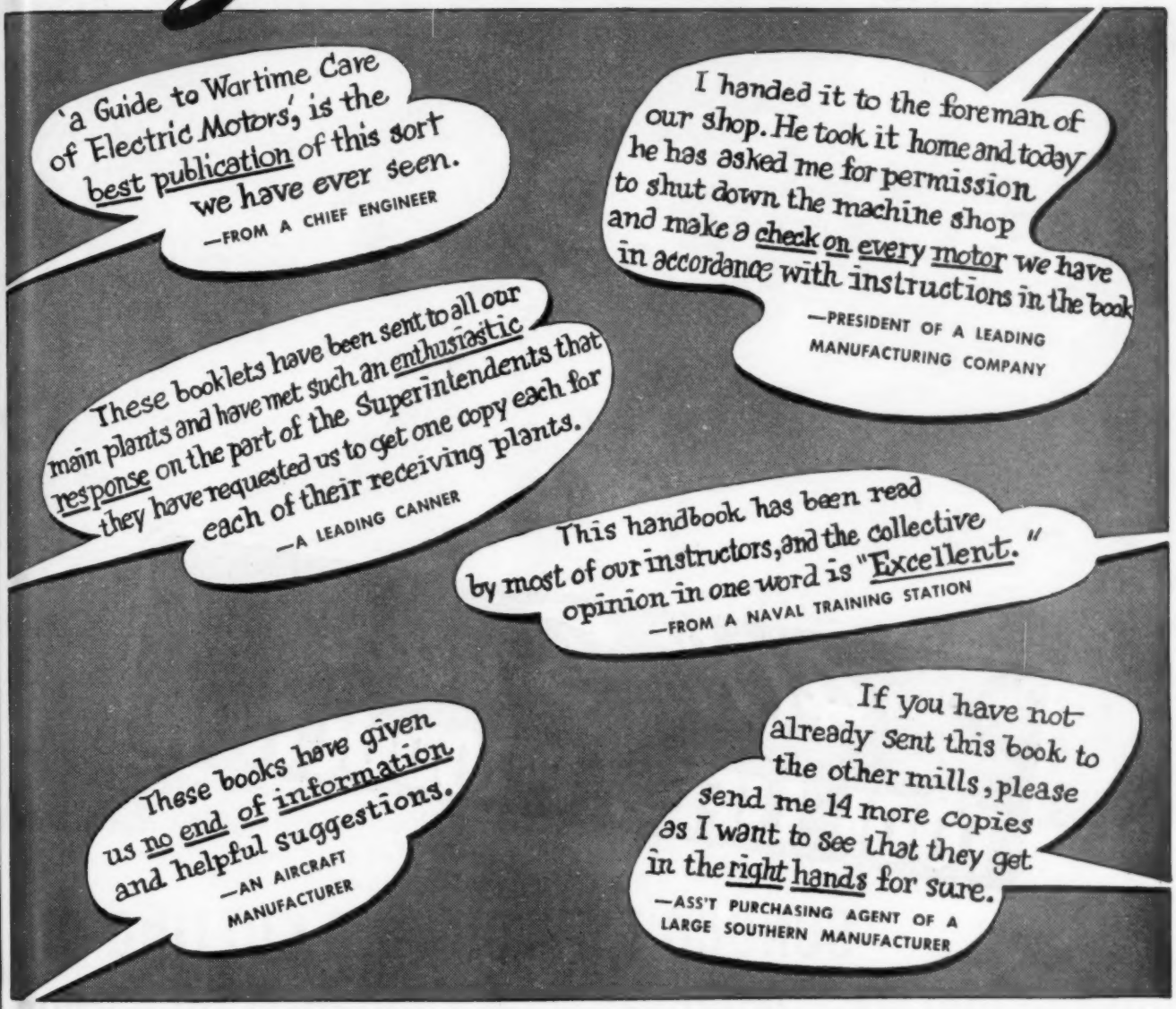


WM. SELLERS & CO., INC., PHILA., PA.

SELLERS 1848

Sellers

Success Story!


'a Guide to Wartime Care of Electric Motors,' is the best publication of this sort we have ever seen.
—FROM A CHIEF ENGINEER
I handed it to the foreman of our shop. He took it home and today he has asked me for permission to shut down the machine shop and make a check on every motor we have in accordance with instructions in the book
—PRESIDENT OF A LEADING MANUFACTURING COMPANY
These booklets have been sent to all our main plants and have met such an enthusiastic response on the part of the Superintendents that they have requested us to get one copy each for each of their receiving plants.
—A LEADING CANNER
This handbook has been read by most of our instructors, and the collective opinion in one word is "Excellent."
—FROM A NAVAL TRAINING STATION
These books have given us no end of information and helpful suggestions.
—AN AIRCRAFT MANUFACTURER
If you have not already sent this book to the other mills, please send me 14 more copies as I want to see that they get in the right hands for sure.
—ASS'T PURCHASING AGENT OF A LARGE SOUTHERN MANUFACTURER

NINE MONTHS AGO Allis-Chalmers offered free to U. S. industry a *new* kind of maintenance book . . . "A Guide to Wartime Care of Electric Motors."

Setting up as targets for maintenance the 9 main ene mies of motor life — dust, stray oil, moisture, friction, misalignment, vibration, uneven wear, overload, underload — this new handbook gave simple, easy-to-get, *wartime* directions for fighting them.

Result? Over *100,000* copies are already in use by the armed forces and war industry — and new requests pour in daily. If you haven't yet obtained *your* free copy, write ALLIS-CHALMERS, MILWAUKEE, WIS. A 1592

ALLIS-CHALMERS MOTORS

When you do need new motors, look into the strength, solidity and all-around protection of the new "Safety Circle"— protected top, sides, ends and bottom.

AC

WE WORK FOR VICTORY

WE PLAN FOR PEACE

SUNOCO EMULSIFYING CUTTING OIL

prolongs tool life... improves finish... increases production

The longer cutting tools last on the production lines ... the more vitally needed war material can be produced for the fighting line.

The value of the right cutting oil in prolonging tool life was amply proved by a large manufacturer of war material. When using a competitive cutting oil production was seriously slowed down because of short tool life ... poor finish ... and bad operating conditions. Then he switched to Sunoco Emulsifying Cutting Oil on his Warner & Swasey turret lathes. The high heat absorbing lubricating qualities of Sunoco stopped the trouble. Results ... tool life and production stepped up 40% ... finish on parts greatly improved.

From metal working plants large and small on America's production front reports such as these are constantly being received. Facts that prove why the majority of metal working plants flood their tools and work with Sunoco to get more pieces between tool grinds, reduce rejects, and make every man-hour and machine-hour result in peak production. Call in a Sun Doctor of Industry, let him prove the production value of switching to Sunoco in your own plant. Write

SUN OIL COMPANY, *Philadelphia*

Sun Oil Company, Limited, Toronto, Canada

SUNOCO

SUN INDUSTRIAL PRODUCTS *HELPING INDUSTRY HELP AMERICA*

MINE MAINTENANCE

with a Super Service Radial

Today in many large plants the Maintenance Shop is one of the most important and vital departments. Nothing less than the most dependable, most versatile tools can be tolerated in such shops.

ARMY E NAVY
AWARDED SEPT. 10, '42

The above photograph shows one of the three Super Service Radial Drills in the UNDERGROUND MAINTENANCE SHOP of a large mine where they are relied upon for a variety of metal drilling operations.

These machines have a wide range of speeds and feeds, long-lived accuracy and features for fast, easy operation. The distinctive features of the Super Service Radial Drills are explained in Bulletin R-24. Write for it today.

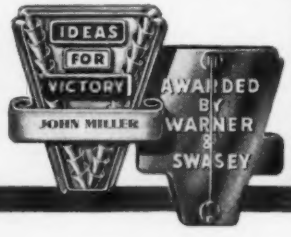
SUPER CB SERVICE

THE CINCINNATI BICKFORD TOOL CO.

OAKLEY · CINCINNATI · OHIO · U. S. A.

Ideas for VICTORY
from the Production Lines behind the Firing Lines

A Citation for Men in War Industry



A SIMPLE IDEA...BUT IT STEPPED UP PRODUCTION 40%

In addition to the Victory Pin presented by Warner & Swasey, operator Miller was awarded a war bond by his company, and a citation from W. P. B. He was also given credit, along with other employees who had contributed valuable service to war production, on a national radio broadcast sponsored by The General Motors Corporation.

ONE of the jobs being machined by John Miller, turret lathe operator at the Cadillac Motor Company, is a gear with shaft extension on both sides. As set up, there was not room enough between the spindle and the bar turner in the hex turret to permit square turret operation while the bar turner was cutting. One shaft extension had to be turned before the second could be rough cut and finished.

But John Miller studied the job and found a solution. By pulling more stock out of the spindle and placing cutters in the right side of the square turret, instead of the left side, he was able to combine square turret cuts with hexagon turret cuts, finishing both ends simultaneously, and saving 3 minutes per piece. The rigidity of the hex turret unit on his No. 5 Warner & Swasey made it possible to use this setup, holding .002 accuracy.

Many turret lathe operators have written us, telling how they used the machines and tools at hand to best advantage. Many of these ideas are passed along in Blue Chips, a shop bulletin mailed free to the homes of over 38,000 turret lathe operators. Are your operators getting "Blue Chips"? Just write Warner & Swasey, Cleveland, Ohio.

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WHAT'S IN THIS ISSUE

NEW USES FOR POWDER METALS

Since Pearl Harbor the powder metal industry has made two important advances of interest to metal fabricators: an increase in permissible weight per piece from 3 to over 100 lb., and the development of structural and tool parts from alloyed irons. On pages 83 to 86 these developments and the specifications of commercial analyses are discussed.

COMPLETED IN A CRADLE

The final assembly work on the Coronado patrol bomber is done with the hull in a moving cradle, flanked with attached platforms which travel flush to a stationary platform extending the length of the line. An article and series of pictures describing and illustrating this assembly method commences on page 94.

CHARLES HAVRANEK

CONCAVE SURFACES MILLED

Through the use of three formulas developed to determine the necessary cutter size and settings, large radius concave cylindrical surfaces may be simply and accurately machined with ordinary circular milling cutters set at an angle to the work. On page 97 the formulas and their applications are given in an article by Charles Havranek.

PLANNING FOR TRAINING

That training programs should not be entered into without due consideration and planning is the theory which has gained the Wright Aeronautical Corporation excellent per trainee results. Before a course is given, the education division determines whether there is sufficient need, and, if there is, lays careful plans for its presentation; consideration is given to the time and the place most suitable to the trainees, the instructor and to any special equipment. And proper weight is given to a variety of considerations to determine which employees shall receive the training. B. H. Saltzer of the Wright Aeronautical Corporation is the author of an article, page 98, telling of the conduct of that company's training program and the various aspects surrounding it.

ROBERT I. MINER

CHUTES CONVEY SHELLS

Cage chutes of welded steel rod are being utilized for moving drawn shells from presses to succeeding operation, after the discharge of the part along curved channels in the bolster plate has proved impractical. The design and methods of construction of these chutes is described by Robert I. Miner, chief engineer, Ryerson & Haynes, in an article beginning on page 100.

ARMOR MILLING TECHNIQUES

The milling of armor plate has been developed to a fine science in the few short months since the present armament program was started. Methods and machines used in producing for the previous war were found unsatisfactory for advanced material manufacturing needs; as a result, studies were made, careful statistics kept, and from the findings machines and cutters were designed. In an article on pages 116 to 120 the design, principles and use of cutters evolved are discussed by Karl B. Kaiser, Ingersoll Milling Machine Company.

EDMOND J. JAMES

WOOD MODELS SPEED THE CORSAIR

Turning the automotive experience of key members in its tool engineering division to tooling up for production of the Vought-Sikorsky Corsair, the Goodyear Aircraft Corporation devoted three months to building wood models, and thereby reduced into-production time by an estimated six months. The careful preparation possible through the use of wood models, templets and plaster male impressions has resulted in a more smoothly functioning assembly line. Edmond J. James, manager, Tool Engineering Division, Plant D, Goodyear Aircraft Corporation, is the author of an article describing the steps followed and the principles involved in that company's use of wood models in the tooling up process. It starts on page 109.

COMING

Production lines have great and steady appetites. To supply them, feeder departments must be well organized and smooth flowing. In a soon-to-be-published article, R. B. Parkhurst, chief industrial engineer, San Diego Division, Consolidated Vultee Aircraft, describes that company's subassembly and feeder departments.

"Tools of Our Trade," the series of articles designed to get new wartime shop personnel into production as soon as possible, will be continued in the next issue with an article on the basic operation of the engine lathe. Like the previous articles of this series, this one will give the beginner, or the candidate for upgrading, the salient facts about the machine: the way it works, how it should be handled, what it will do.

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Powder Metals Find Wide Use

Production bottlenecks created by lack of skilled labor and machine tools are being broken by an industry that is just emerging from infancy, when one considers its future possibilities

By recognizing the field for powder-metal parts in armament, production men and designers in war plants have been governed by these factors:

1. The need to save copper. Industry was quick to accept iron-copper and pure-iron self-lubricating bearings to replace bronze bearings, where specifications could be altered for trucks, tanks, aircraft and cannon.

2. Scrap losses in machining bar stock, forgings and castings for armament parts runs between 30 and 70 percent, are often higher. A powder-metal part weighing 17 lb. consumes exactly that weight of powders. Where the character of the load has permitted, structural parts have been made from powder metals to save scrap losses and machining time. One company estimates that over 5,000,000 lb. of scrap will be avoided during the current year through the use of powder-metal parts.

3. The saving of manpower is another important reason for use of powder-metal parts. Time cycles for the processes involved are comparatively short; briquetting, for example, requires from 1 to 15 seconds ordinarily. To manufacture a bronze gun-sight bracket by contour machining takes 2½ hours, by briquetting the part is formed in 12 sec. The Chrysler Corporation was informed that, in producing 20,000 sets of parts for a gun mount (90 parts per set), approximately 5,000,000 man-hours were saved in 1942.

4. The tooling up for production by conventional methods often requires new machinery, certainly tools, fixtures and time. Few additional machines are required for powder-metal parts, other than those necessary in the vendor's plant to keep pace with expanding production or increase in part size. Dies are made in a matter of days or a few weeks. Actual production of an order may be realized before the tooling for a conventional processing layout has been designed.

5. Important cost savings are a consequence of avoiding scrap losses, complex tooling and machine installations. Comparative figures are unobtainable because of the secrecy which surrounds war production, but the nature of the parts accepted for manufacture by producers of powder-metal parts indicates that important savings are being obtained.

WAR PLANTS are saving millions of man-hours of labor and the cost of tooling of production lines as the outcome of progress in powder metallurgy since Pearl Harbor. In addition to the well-known "oil-less" bearing, manufacturers of powder-metal parts are now supplying structural components for aircraft, ordnance, instruments and precision tools. These parts, made from bronze, iron-copper, pure iron, even tool steels, have the advantage that they can be used with little or no machining.

Before the war, sintered parts for machine use seldom weighed over 3 lb., and they were supplied almost entirely in the form of self-lubricating bronze bearings. Currently, items weighing 60 lb. have been produced. Further increases in size and weight will be realized with the installation of more powerful processing equipment.

The "know how" required for war products rests upon a solid foundation of research, commercial application and insistence upon American standards of quality in peacetime. In the field of ferrous materials, the Chrysler Corporation for example had been in production since 1930. Sponge iron, obtained from Sweden, was used before hostilities, but American sources have been encouraged to produce iron pow-

ders which are far better for the purpose than those supplied from Europe. Some of these iron powders are produced electrolytically, but a portion is now made by reclaiming mill scale, a waste product, instead of using steel scrap. Two facts are outstanding. First, powders can be processed to possess physical properties comparing favorably with cast or wrought products. Second, tailor-made physical and electrical properties are attainable.

These achievements are realized for production runs by close control over the processing steps and an intimate knowledge of the physical and metallurgical sciences. The business is therefore concentrated in the hands of specialists who buy materials from metal powder manufacturers and follow these steps to produce parts: First, powders are selected on the basis of purity, particle size, flow, density, voids, and intrinsic hardness or softness, and mixed in the desired proportions. The weight of powders consumed per part is equal to the finished part weight, because there are no melting losses.

The second major step is to rescreen the powders to make sure that only particles of uniform range in size are carried into the briquetting die. The powders are automatically fed into the die with very close control for weight and size, so that the compact, which is approximately one-third the volume of the powders, will come to required dimensions. The briquetting process is controlled for the desired degree of porosity in the case of bearings, or to insure greater density in solid parts. Fourth, strength is developed in the "green" compact by sintering, which is a heat-treating process designed to develop a bond between the particles. Fifth, the part is sized by pressing or sizing. Sixth, supplementary heat-treatments, usually of a specialized nature, may be added to develop properties similar to wrought materials.

Technicians in the powder-metals industry admit that they do not fully understand the phenomena by which strength is developed by the sintering process. With bronze, sintering is carried out at a temperature above that required to melt the constituent (tin) with the lowest melting point. In sintering the iron-copper materials, the copper probably melts and acts as a matrix for the iron particles. Pure-iron particles become plastic at the selected sintering temperature and are considered to weld themselves together. Alloyed irons and steels are said to develop a structure that cannot be distinguished under the microscope from cast materials. Steels have been made with a hardness up to Rockwell 65 C, and tensile strengths of 140,000 lb. per sq. in. have been achieved.

Producers of powder-metal parts supply bearings and structural parts largely within the specifications listed in the accompanying table. Bronze, iron-copper and iron bearings are used more or less interchangeably. The ferrous bearings have adequate service life at

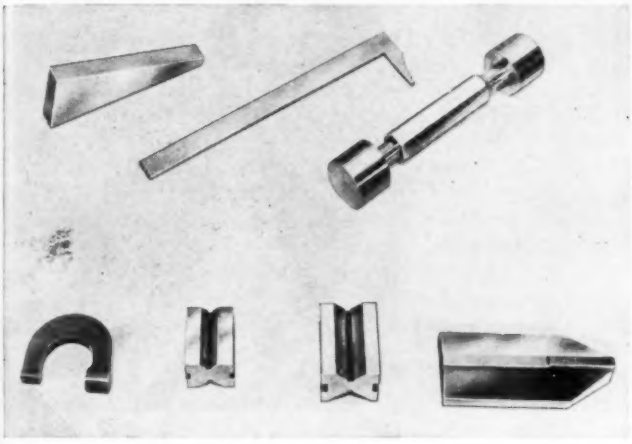
PHYSICAL PROPERTIES OF BRONZE, IRON-COPPER AND IRON POWDER METALS

Material	Ultimate Strength		Loading		Load for Permanent Set of		Elongati
	Tensile	Compressive	Static	PV Factor	0.001 In.	0.005 In.	Percen
Bound Brook Oil-Less Bearing:							
Compo Bronze (88.5 Cu, 10 Sn)..... Bearings and parts	12,000	69,000	7,500	50,000	10,500		25–35
Powdiron 55–P (95 Fe, 5 Cu)..... Bearings and parts	12,000	140,000	15,000	50,000	16,000		25–40
Powdiron 61–1C (90 Fe, 10 Cu)..... Heavy duty parts	30,000	140,000	20,000	60,000	17,000		60–90
Powdiron 51–1 (100 Fe)..... Special parts	12,000	130,000	20,000	50,000	22,000		35–50
Chrysler Corp. Amplex Div.							
Oilite Bronze (90 Cu 10 Sn):							30
Bearings and Parts.....	12,500	120,000	8,000	75,000	11,000	16,000	5
Machine Parts Heavy Duty.....	18,000	200,000			20,000	25,000	10
Machine Parts Maximum Duty.....	40,000	230,000			30,000	35,000	20
Super-Oilite (75 Fe, 25 Cu):							45
Bearings and Parts.....	30,000	198,000	46,000	50,000	30,000	47,000	1
Machine Parts Heavy Duty.....	35,000	190,000			35,000	50,000	2
Machine Parts Maximum Duty.....	45,000	250,000			40,000	55,000	2
Iron Oilite (100 Fe):							40
Bearings and Parts.....	15,000	130,000	20,000	50,000	22,000	40,000	1
Machine Parts Heavy Duty.....	30,000	120,000			30,000	50,000	2
Machine Parts Maximum Duty.....	35,000	150,000			35,000	55,000	2
Keystone Carbon Co.							
Selflube Bronze (90 Cu, 10 Sn).....	14,000			45,000	11,000†		
Selflube Iron (95 Fe, 5 Cu).....	16,000			50,000	30,000†		
Selflube Iron (90 Fe, 10 Cu).....	40,000			.....	50,000†		
Moraine Products Div., General Motors							60–90
Durex Iron (88 Fe, 12 Cu).....	25,000		15,000	50,000	20–25,000		Nomi 25–40
Durex Iron (100 Fe).....	20–35,000				10–15,000		3–12 65–100
Durex Bronze (89 Cu, 10 Sn).....	12,000		7,500	50,000	11,000		
Durex Bronze (95 Cu, 5 Sn).....	30–40,000				12–20,000		5–10
United States Graphite Co.:							
Grade 61 (90 Cu, 10 Sn).....	21,000		7,000	50,000	14,000	18,000	
Grade 81 (90 Cu, 10 Sn)..... Slight graphite addition	14,000		6,000	50,000	9,000	13,000	
Grade 86 (85 Fe, 15 Cu)..... Slight graphite addition	20,000		15,000	50,000	16,000	24,000	
Grade 139–U (100 Fe).....	10,000		10,000	50,000	14,000	18,000	

* Data based on standard ASTM specimens
† In Compression—2%.

Toolmaker's accessories, micrometer frames, gage parts constitute the newest application of powder metals to matters concerning the metal-working industry. Produced from tool steels, these pieces are at least 75 percent finished when received by the customer, and are being produced so speedily that heavy current demands will soon be supplied

Courtesy, Amplex Division, Chrysler Corporation



Courtesy, Amplex Division, Chrysler Corporation

Bearings for ordnance will probably soon be produced in weights twice as great as any example above. The large thrust bearing at the center is 18 in. in diameter and its weight is many times greater than prewar achievements

NTERED CONDITION

rdness Brinell	Porosity Oil by Vol. %	Weight Per Cu. In.	Coeff. Thermal Exp./deg. F.
25–35	27	0.228	9.8×10^{-6}
25–40	32	0.199	7.2×10^{-6}
60–90	25	0.221	7.7×10^{-6}
35–50	25	0.214	6.8×10^{-6}
30	30	0.22	10.5×10^{-6}
30	..	0.25	.....
60	..	0.30	.....
45	25	0.23	7.7×10^{-6}
60	..	0.25	
90	..	0.256	
40	30	0.22	6×10^{-6}
70	..	0.230	6.8×10^{-6}
90	..	0.24	7.0×10^{-6}
	24	0.222	
	29	0.195	
	24	0.212	
60–90	20–30	0.20–0.22	$6.5–7 \times 10^{-6}$
35–70	10–25	0.21–0.24	$6.5–7 \times 10^{-6}$
25–40	20–30	0.22–0.25	10×10^{-6}
65–100		0.29	
	20–25	0.237	9.7×10^{-5}
	20–30	0.223	9.7×10^{-5}
	15–20	0.210	7.1×10^{-5}
	20–25	0.199	6.8×10^{-5}

shaft speeds up to 4,000 r.p.m. where the conditions are not unduly corrosive.

For armament work, powder-metal parts are customarily listed as an alternate material with its own specifications. It is understood that manufacturer's specifications have in the main equalled or exceeded government requirements to date. However, the issuance of basic Ordnance specifications is expected within a few weeks.

The physical specifications written for other materials are not ordinarily met in powder metals, because the processing of the latter is so special that variations from customary standards are almost certain to be the rule.

Hardness of powder metals cannot be accurately indicated by any test of porosity, which is present in some degree except with those parts finished by some heavy rolling or pressing process. On the other hand, hardness is generally valuable only as a means of determining wear resistance or other properties of the metal involved. Wear resistance, other things being equal, is largely a function of crystal hardness. The crystal hardness of a powder-iron part will be identical with that of steel of the same analysis, given the same heat-treatment. The mass hardness, however, may often be much less.

In other words, experience has shown that the physical and chemical characteristics of powder-metal parts are not a true criterion of the ultimate performance to be expected from them. Many cases have arisen where a powder-metal part with much lower physical characteristics has out-performed a cast or forged part. Manufacturers therefore lean to the opinion that specifications should be set up after performance tests as a check upon uniformity of quality.

Powder-metal parts can often be tailor-made to specifications peculiar to an application, avoiding the compromise that may otherwise be imposed by limitations of melting or machining practice. The advantages of tailor-made materials have become so evident from specific examples of war work that manufacturers of powder-metal parts now ask full data on the desired service characteristics. Thus, many production bottlenecks have been broken, much strategic material has been conserved, costly tool-up avoided, and schedules greatly expedited through powder-metal bearings and machine parts.

Examples of jobs selected on this basis indicate the spread of knowledge beyond the confines of the materials specified in an accompanying table. Cores for small motors, a device that is used in great quantities for aircraft controls, had been made of laminations. The motor manufacturer asked that powder-metal parts be made from the same specification. But by a study of the electrical characteristics required, the vendor provided an alloyed material that gives more efficient service and costs much less than the original part.

The intrinsic hardness or softness of pure materials is taken advantage of in other new applications of powder-metal parts. Cast silicon irons contain a maximum of 15 percent silicon, by reasons of limitations in melting practice. Since there are no slags produced in the briquetting and sintering processes, as

much as 40 percent silicon has been added to iron powder.

Iron of 99+ purity is extremely soft and ductile, as measured by standards of common experience. These properties lend themselves to the production of driving bands for shell. Made in experimental lots, the rings are made with little allowance for finishing.

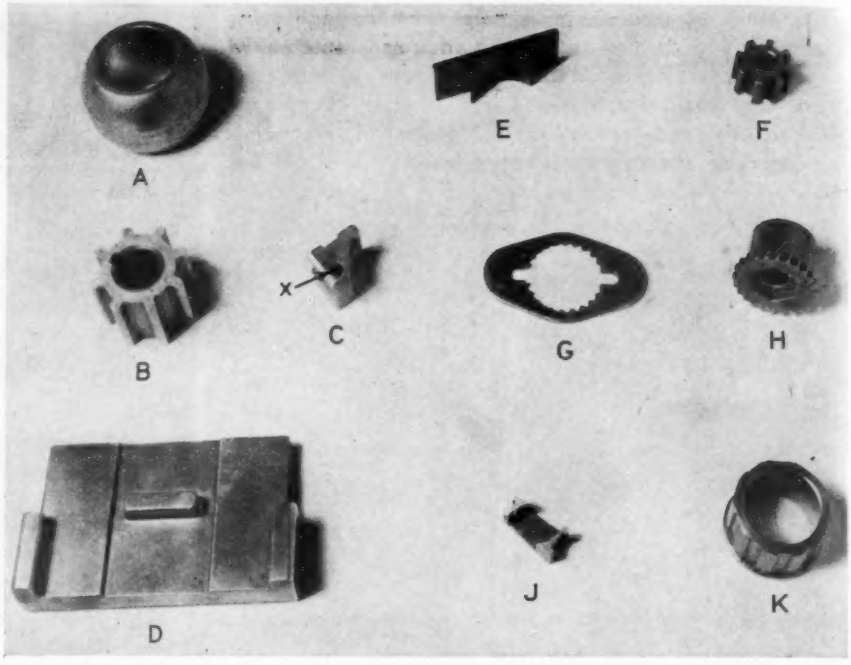
Despite war-inspired applications of powder metals to bearings and structural parts, a word of caution is indicated. There are definite limits of availability, as mentioned—and there are process limitations. Most parts are cylindrical in form, but some are flat or dished shapes that can be produced by the briquetting process. Holes, recesses, splines that can be made by punch travel are readily produced. The height relationship of blind holes and recesses with respect to the base of the piece can be held to a few thousandths.

No draft need be specified on the diameter of the parts or for vertical holes and recesses. On the other hand, holes or recesses that must be made by side-operating cores are not particularly feasible at this time, although they have been produced in some cases.

For almost all cylindrical pieces, the tolerance on outside and inside diameter can be held to ±0.0005 in. for parts up to 2 in. in diameter, to ±0.001 in. for diameters from 2 to 5 in. Such tolerances are attained usually for special operations rather than for commercial production.

Tolerances for length are not as a rule held as closely as for the diameter. Control of length in briquetting rests primarily upon the uniformity of the powder. On the whole, length dimensions can be held to ±0.005 in. for the entire range.

With these tolerances and the present limitations of briquetting dies in mind, most jobs selected will require little if any machining. For machining non-porous parts, speeds and feeds and tool angles, should approximate those for wrought materials of similar composition and hardness, and modifications in machining practice will be established by experience. Carbide tools are recommended particularly for long production runs. With the porous bearing materials, the precaution to be observed is: a dead sharp tool to avoid spreading metal over the surface pores. Tungsten carbide or diamond tools are preferred when finish boring is required for bearings. The front rake on the tool should be from 8 to 10 deg., the side rake about 8 deg. Such tools are used at speeds up to 350 surface feet per min. and finishing cuts at feeds from 0.003 to 0.005 in. If roughing cuts are required, normal practice applies.



Courtesy, Amplex Division, Chrysler Corporation

Many larger parts are being made from bronze and ferrous materials, but these examples serve to show the kind of workpieces that can be produced to close limits, and in a fraction of the time required for customary tooling up

DESCRIPTION OF BRONZE AND IRON PARTS

A—Self-lubricating bronze bearing of the self-aligning type for a tank control mechanism. This part requires no machining since the spherical bearing surfaces and the bore are held to 0.001 in. in manufacture. While the self-lubricating property is available for contact with both the shaft and the special housing, the part as made has structural values as well.

B—Bronze impeller for marine-engine pump. This metal powder piece is an outright substitution on a cost basis for the wrought bronze specified originally. The bore is held to 0.001 in., and the keyway to customary limits without machining. Main reason for lower cost is the inclusion of the "teeth", which are too high for extrusion on bar stock and costly if hobbed from the solid.

C—Combination bracket and bearing for aircraft installation. The self-lubricating quality is required because of the bearing hole *X* molded in the part. Screw holes and locating guides in the bracket, being at right angles to the line of travel for the briquetting punch, are machined.

D—Non-porous bronze bracket for a gun sight. This piece is made of powder metal to avoid contour machining, and is produced in bronze to meet gun specifications. As the part comes from the mold, it is finished to desired limits, and only a couple of holes are drilled.

E—High-density iron pole piece for electric motor. This part, produced in enormous quantities, represents an example of maximum cost savings permissible with powder metals, in comparison with the machined counterpart. In the original piece, electrical properties were sacrificed to ease of machining from steel. By molding the part from powders selected to give the desired hysteresis characteristics, motor performance is improved and the cost is sharply reduced.

F—Dense iron rotor for electric motor. The part was originally made of laminated punchings. It is desirable for electrical reasons to make the piece from the solid, but the cost of machining a silicon steel would be prohibitive. Thus in this case, also, the electrical properties are improved by freedom to compound powders to the ideal analysis. The cost reduction is more than for the pole piece.

G and **H**—Dense iron components of a gun-turret mechanism for aircraft. The gear on hub *H* must slidably engage the internal gear on plate *G* at any desired control position, and backlash is limited. The hexagon recess in the hub and the eccentric shaft hole are produced in the molding process.

J—Self-lubricating iron segment for a cam track applied to an electrical control device for military equipment. Segments are set continuously in a frame, and the roller track so produced forms a contour smooth curve. Locking slots and the cam track in each segment are held.

K—Self-lubricating iron bearing and part for the track of a heavy duty mobile unit for the war program. This part serves as a bearing and a spacer. The external splines are produced in the molding process and end at the shoulder.

Due credit is given the following organizations for data supplied by them toward the preparation of this article.

Amplex Division, Chrysler Corporation
Bound Brook Oil-Less Bearing Company
Henry L. Crouley & Company, Inc.
Keystone Carbon Company
Moraine Products Division, General Motors
United States Graphite Company

Simplified Grinder Aids Production

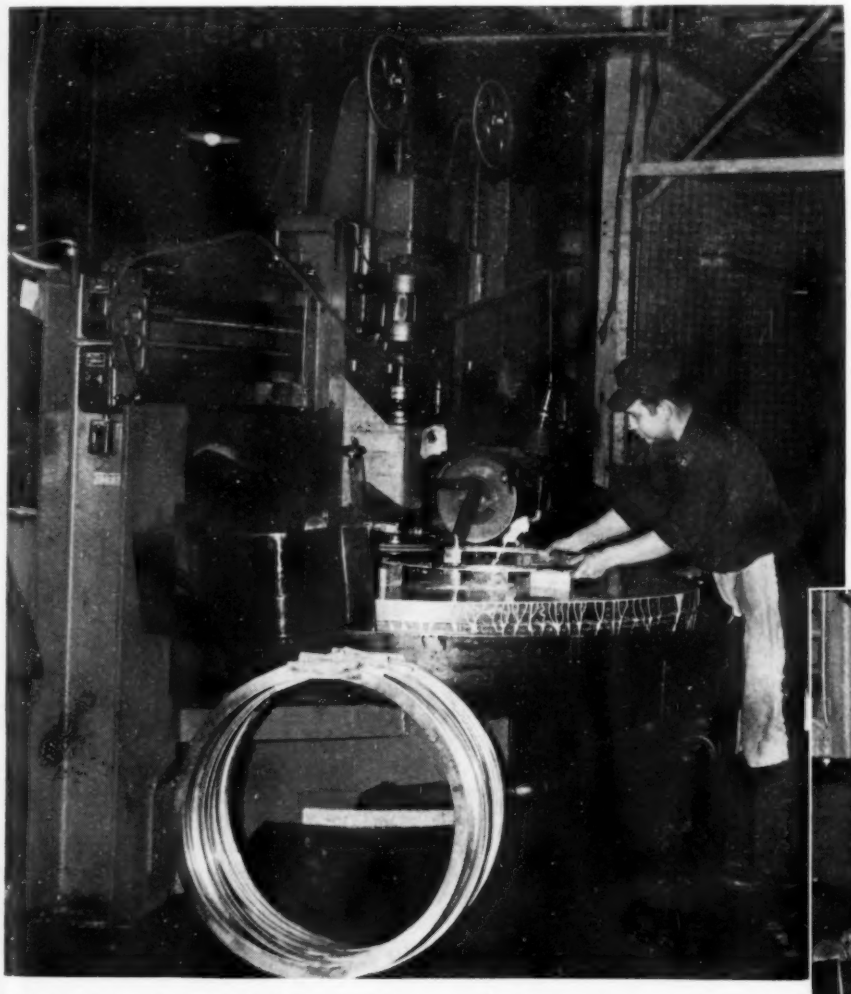
BY S. L. HUFFMAN, THE TIMKEN ROLLER BEARING COMPANY

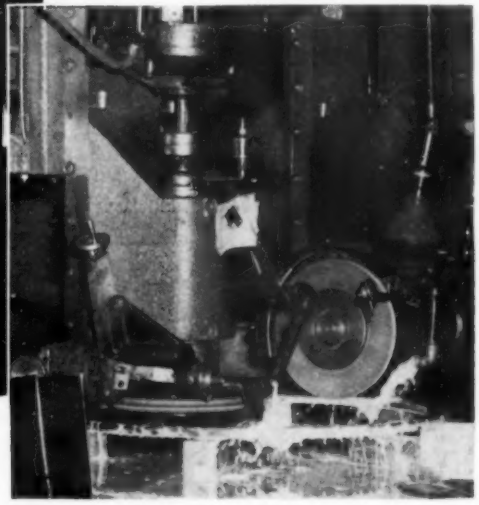
IN ATTEMPTING to expedite precision ground war material at its Canton plant, The Timken Roller Bearing Company found that certain supplementary operations on large workpieces not requiring a high degree of accuracy were, because of the large sizes of the workpieces, being finished on grinders sorely needed for more precise operations. This work included the grinding of the male radii on cone ribs, bores, cup outside diameters, and angle chamfers on cup inside diameters. A relatively simple and inexpensive machine was built exclusively for such jobs, which not only proved satisfactory but also effected an increase in production over that from the precision grinders.

The frame of the machine, fabricated by welding structural shapes, required no machine work. The table top is 72 in. diameter, also of welded steel, and has a driven pulley as an integral part of its construction. It is supported by roller bearings on a cast-iron table support bolted to a sheet of boiler plate welded integral with the frame. Pains were taken when welding the frame to get the colums square with this plate. The cross-rail is of cast iron, bolted and doweled to the columns, and was shimmed to be parallel and square with the table top. The table top was ground in place by the machine's own spindle to insure the necessary accuracy between these two parts.

The rail carries two self-contained grinding heads—the left one having a vertical spindle and the right one a horizontal spindle mounted on a swivel. Both spindles are mounted on roller bearings. For the sake of simplicity, the counterweights are suspended by chains over sheaves and are carried along with the horizontal saddle. Horizontal traverse is effected by a hand-operated screw fixed to the rail and a stationary nut fixed to the saddle. Vertical traverse is by a hand-operated splined shaft fixed to the rail through right-angle spiral gears, the driven one of which carries a revolving nut fitted to a stationary screw carried by the slide. Each head is operated independently from its respective end of the rail and is powered by a 5-hp. motor. Since all operations on this machine are plunge cuts, economy in construction was effected by elimination of all power traverse.

The table is driven by a two-speed right-angle gear motor with a V-groove sheave on the countershaft and a flat pulley integral with the table. The motor plate is mounted on channel-iron slide rails to obtain necessary belt adjustment. This machine proved so successful that five others of like design but with 48-in. tables were built.





Machine for plunge grinding operations requires no power traverse of grinding heads. Used for secondary operations, it releases precision grinders for work held to close tolerances

Shotblasting Aircraft Engine Parts

Cooperative action by production men in the aircraft-engine field bids fair to improve quality and save manpower by evolving changes in methods for finishing parts that have been highly polished. Organized a year ago as the Aircraft Engine Division of the Automotive Council for War Production, but now known as the Aircraft Engine Production Committee of the Central Aircraft Council, the group has exchanged information since January 15, on the subjects of shotblasting, gear shaving and other techniques.

The present program grew from the suggestion advanced by the works manager of a large Eastern plant that these subjects should be studied on a cooperative basis, as a means of avoiding too much "dolling up" of certain engine parts. Representatives of Pratt & Whitney, Wright, Allison, Buick, Cadillac, Chevrolet, Chrysler, Continental, Nash, Packard and Studebaker, meet monthly to discuss progress. An outline of what has been learned by the group with respect to shotblasting is presented

TWO OBJECTIVES are sought in the production research being carried on with respect to shotblasting: (1) to eliminate the tedious final polishing that has been deemed essential on connecting rods and other finely finished engine components, and (2) to impart extra fatigue strength to the part by pre-stressing the surface of the metal. Complete or partial success is indicated for connecting rods, rocker arms, master rods, link rods, crankcases, impellers, magnesium housings, valves and valve spring washers. Knuckle pins and similar parts which are stress points will probably also be shotblasted. It is asserted that when parts are so treated, corrosion, corrosion fretting and even grinding notches can go entirely through the shotblasted layer before any serious harm is done to the article.

Considerable time savings are realized where the shotblasting process is found suitable. The customary final polishing operation is eliminated. Instead, the piece is rough polished (that is, a fair grinding job is produced with a 70- or 80- grit wheel) and then shotblasted. No additional operations or inspections are required.

Examples of time savings realized with shotblasting are as follows:

Connecting rods. The manufacturer of one aircraft-type engine polishes connecting rods with a 70-grit wheel to achieve a surface finish of 75 micro-inches, then shot blasts with 0.027 in. shot in four positions to reach all surfaces. Control of the process is achieved by the size of the shot and time limits per piece. Elimination of fine polishing in this instance saves 30 hours per 12-cylinder engine.

Another engine producer is saving three hours per connecting rod by shot blasting, or 36 hours per engine.

Rocker arms. These have been rough polished with an 80-grit wheel to 150 micro-inches, then blasted with 0.027 in. shot. The saving per engine amounts to 12 hours.

Gears. Neither good or bad effects were observed on the teeth of a shotblasted reduction gear pinion. The teeth were hard—Rockwell 60 C—and the gear ran under test for 50 hours.

The piston-pin hole in a master rod is being shotblasted by one engine manufacturer as a means of preventing the pin from turning in the hole.

Elimination of manual and machine polishing as the final processing step is, however, the main approach. There is still some question as to what is the proper, or maximum, surface roughness permissible on the part before shotblasting. The 80-grit wheel seems to find the most favor for "rough polishing" to a profilomter reading of 150 micro-inches. The basic finish must be good enough to avoid tool marks from showing up on the part after shotblasting.

The value of shotblasting as a means of increasing the fatigue resistance of aircraft engine parts is revealed by test data available for some parts components. One manufacturer reported that the fatigue life of shotblasted connecting rods was at least equal to the highly polished rod. Another stated that a ten-fold increase in fatigue life was secured for connecting rods, a 30-fold increase for the crankshaft.

According to an authority, the surfaces of repeatedly stressed parts are much more vulnerable to fatigue than the deeper layers, no matter how perfectly the surface is finished. Fatigue resistance is increased if a thin layer of the part is pre-stressed in compression by a peening operation, such as shotblasting. On the other hand it is possible to overdo shot-

blasting and thereby promote early failure of the part. Reason is that when the surface layer is stressed in compression, the interior is stressed in tension, and value of the latter can become too high for the section involved if the shotblasting is prolonged.

Determination of the size and shape of the shot, distance of nozzles from work, velocity, time of blasting and other variables are presently best established by experience. Comparative studies should be made for the purpose of writing process specifications. Some data show that the time should range from 5 to 10 sec. for each of the four passes over a connecting rod, for example. Rocker arm levers have been shotblasted with two ½-in. nozzles placed 2 in. from the work and directing No. 30 steel shot upon it at a pressure of 80 lb. per sq. in. The time for treatment of each side of the lever was 15 sec.

In the absence of data from which to predict the depth of pre-stressing of the surface layer on the work, members of the committee are employing an empirical method devised by J. O. Almen of the Research Laboratories Division, General Motors Corporation. With his method a thin metal strip is fastened to a heavy base and subjected to the same shotblasting action as the workpiece. The strip is then removed, and will be found to be curved, the convex surface representing the cold-worked side. The depth of the stressed layer is determined by measuring the curvature of the strip with a pair of knife edges and a dial indicator.

It is possible to calculate the compressive stress at succeeding layers from the surface by honing off small increments of metal and then measuring the curvature. The changes in curvature thus revealed form the basis of stress calculation.

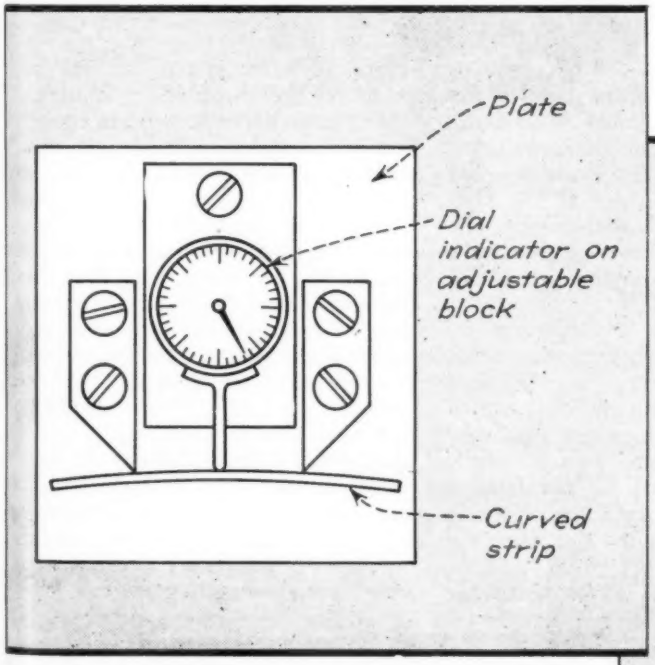
Several sizes of test strips have been developed. One is 0.050 in. thick and is used to test the shotblasting effect on aluminum, another is 3/32 in. thick and finds use with the heavier steel sections. Test strips have been furnished to the various committee members by the American Foundry Equipment Company. This concern and the Pangborn Corporation are now working with the committee upon shotblasting problems.

Some committee members lean to the opinion that there are two drawbacks to finishing engine parts by shotblasting, namely, distortion of thin sections and the tendency to cover up Magnaflux indications. Parts such as connecting rods tend to increase in length under peening action. The growth has amounted to as much as 0.008 in. measured at the hole centers. For this reason, one producer provides a new locating spot after shotblasting and then finish machines the piece.

There is some danger of missing the slightest Magnaflux indications, but it is asserted that any important defects close to the surface will show even after shotblasting, if red powder is used in the test. One committee member with considerable experience with shotblasting of engine parts declares that any Magnaflux indications that do not show up after the peening action are not worth worrying about. It is rather definite, he says, that flaws which cannot be seen after shotblasting are not of the kind that will cause the part to fail.

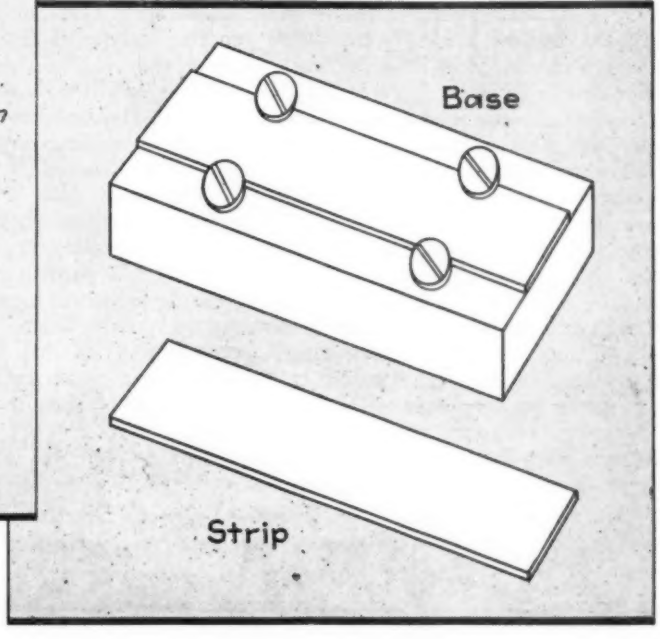
Various protective means have been employed to avoid shotblasting effect upon certain sections of the work. Lead plating has been used. Rubber plugs have been fitted into holes, or rubber shields applied at other points. Disagreement has been expressed concerning bad effects of a juncture between shotblasted and non-treated areas of work pieces. Cracks have appeared in the area not shotblasted, according to one company representative, but a line of demarcation between the treated and non-treated areas does not necessarily weaken the part. Wire brushing across the demarcation line has been suggested as a means of avoiding cracks.

Shotblasting may also prove a means of reclaiming parts. In one case four connecting rods were rejected after Magnafluxing. After shotblasting no flaws could be discovered. An authority on fatigue stresses stated that in this case surface defects had been corrected by shotblasting.



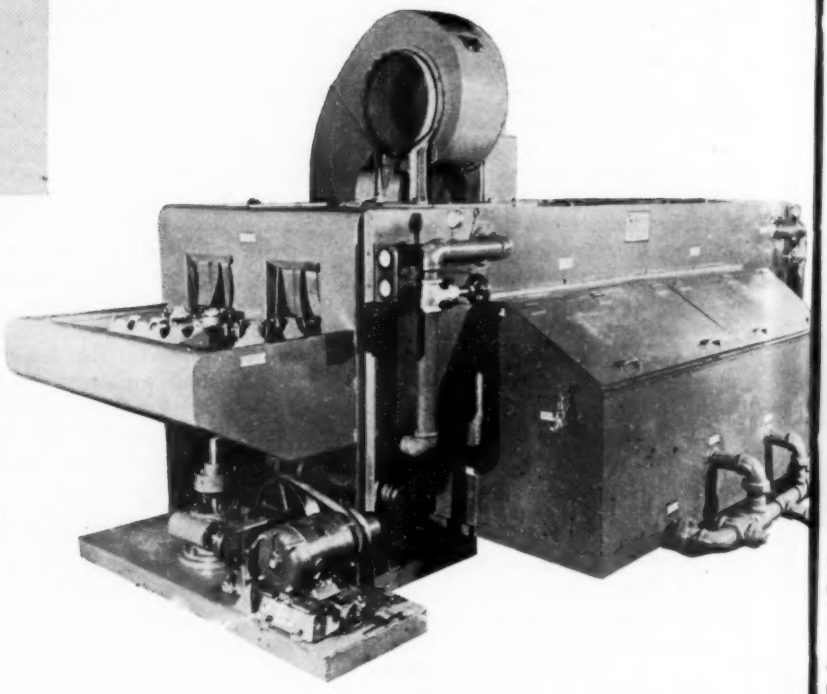
Right—Depth of the surface layer pre-stressed by shotblasting is checked with a test strip mounted on a heavy base and put through the process with the work

Left—Curvature of the work-hardened strip is measured on this fixture. Arc height for standard test strips, when processed with connecting rods, might range from 0.012-0.014 in.



Continuous Machines fo

This discussion of metal-washing machines for high production is the fifth and last of a series on the factors involved in choosing cleaning equipment. Earlier issues have treated materials, methods, simple tanks and washing machines



Chain conveyors offer an opportunity to design machines having one station loading and emptying. This shell cleaning machine washes, rinses and drys the cases in one operation. The conveyor is arranged at loading table height

WHEN WORK can be placed on a conveyor and carried through the several stages of a complete cleaning cycle without being unloaded, much production time can be saved. For this reason, continuous machines are the commonest form of mechanical washing device.

Continuous washing machines may make use of all methods of cleaning: dip tanks, spray systems, pickling, tumbling and burnishing barrels. They may also include drying and cooling facilities. They may handle small parts in bulk, or large assemblies which must be handled individually. They may be designed for use with emulsifiable, solvent or alkaline cleaners. And any assortment of these factors may be combined into one machine.

However, the feature that distinguishes continuous machines from discontinuous is the presence of conveyor systems to carry the parts through the various cleaning stages. The simplest conveyor is probably the flat endless belt with a bottom return. This may be used with or without special holding devices. Another simple form is the overhead endless chain from which racks are suspended to hold the work. These two conveyors may be combined in one dual-purpose machine. Both types of conveyor are adaptable to straight-line production.

Where the flow of parts requires that work be loaded and unloaded at one point, two types of machine are available. An endless link belt may be mounted horizontally to carry work through one cleaning section and back through another. This may be either an overhead carrier or a flat link belt with special holding devices.

Rotating platform machines also give one-point loading and discharge. The platform is divided by partitions into several sectors, the number depending on the number of cleaning stages. Spray nozzles, draining sections, cooling and drying devices are mounted about the circumference of the platform so that all work concurrently. The platform may be at floor level or waist height, depending on the size of the parts to be handled.

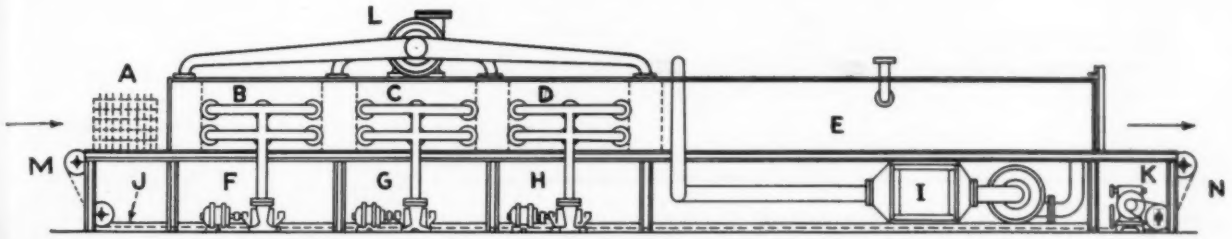
Small parts may be cleaned in revolving drums which feed from drum to drum by gravitation or screw motion. This style is particularly adaptable to cleaning sequences requiring a burnishing operation. Where space is limited, or where work may be fed from a higher to a lower level, the revolving drums may be mounted one above the other.

The design of the drying-cooling section of a continuous machine depends on the shape and size of the work. Large heavy parts retain enough heat to be self-drying, but usually must be cooled by large blasts of low velocity cold air. Small light parts on the other hand cool too quickly to be self-drying. For these, high velocity air at about 180 F. may be satisfactory. Parts between these extremes may be effectively handled by slightly warmed air at very high velocity; the purpose in this case being to blow the droplets from the work. In any case, the parts should be delivered both cool and dry.

Where involved shapes are concerned, it may often be impossible to obtain the correct balance between cooling and drying in one section. In this case, it will be necessary to design separate drying and cooling sections.

BY DR. R. W. MITCHELL, TECHNICAL DIRECTOR, AND MARCEL T. ZINTY, CHIEF ENGINEER, MACHINE DIVISION, MAGNUS CHEMICAL COMPANY, GARWOOD, N. J.

for Productive Metal Washing

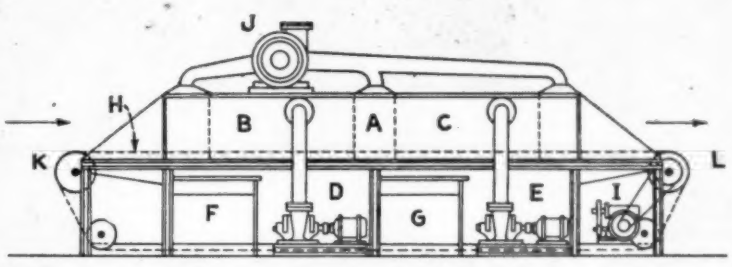


A – Parts
B – Washing section
C – 1st rinsing section
D – 2nd rinsing section
E – Drying section
F – Washing pump
G – 1st rinsing pump
H – 2nd rinsing pump
I – Drying device
J – Conveyor
K – Conveyor drive
L – Vapor exhauster
M – Loading end
N – Unloading end

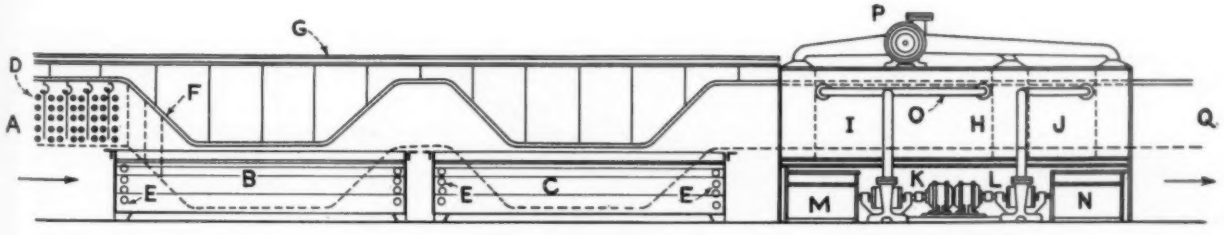
The combinations of washing and rinsing can be extended as required. This machine may have a spray section for precleaning, washing and rinsing and a hot air drying section.

A typical flat conveyor machine might consist of two sections, one for washing, one for rinsing. The work is loaded at one end and issues at the other. Two pumps power the sprays, while a separate drive powers the conveyor

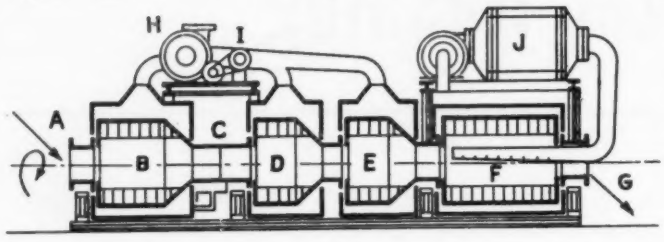
Overhead trolleys may be used to integrate dip cleaning into production flow. Parts requiring plating are dip washed and rinsed before being given an alkaline spray wash and water rinse in one sequence



A – Tunnel
B – Washing section
C – Rinsing section
D – Washing pump
E – Rinsing pump
F – Washing solution strainer
G – Rinsing solution strainer
H – Conveyor
I – Conveyor drive
J – Vapor exhauster
K – Loading end
L – Unloading end

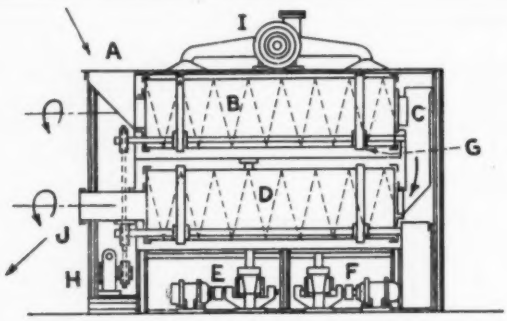


A – Loading end
B – Soaking tank
C – Rinsing tank
D – Work
E – Heating coils
F – Overhead conveyor
G – Conveyor framework
H – Washing machine
I – Washing section
J – Rinsing section
K – Washing pump
L – Rinsing pump
M – Washing solution strainer
N – Rinse solution strainer
O – Sprayers
P – Vapor exhauster
Q – Unloading end



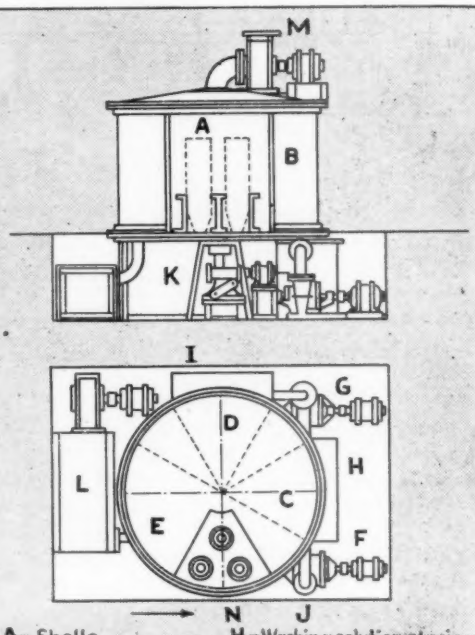
A – Loading end
B – Pickling & degreasing
C – Draining drum
D – Rinsing
E – Rinsing or neutralising
F – Drying drum
G – Unloading end
H – Vapor exhauster
I – Driving device
J – Drying device

Revolving drum machines may be inserted in the production line to handle small parts in bulk. This particular machine has five stages: cleaning or pickling, dripping, rinsing, neutralizing, and hot blast air drying. Loading and emptying devices can be added



A – Loading point
B – Washing drum
C – Washing drum discharge
D – Rinsing drum
E – Washing pump
F – Rinsing pump
G – Rollers
H – Driving device
I – Vapor exhauster
J – Unloading point

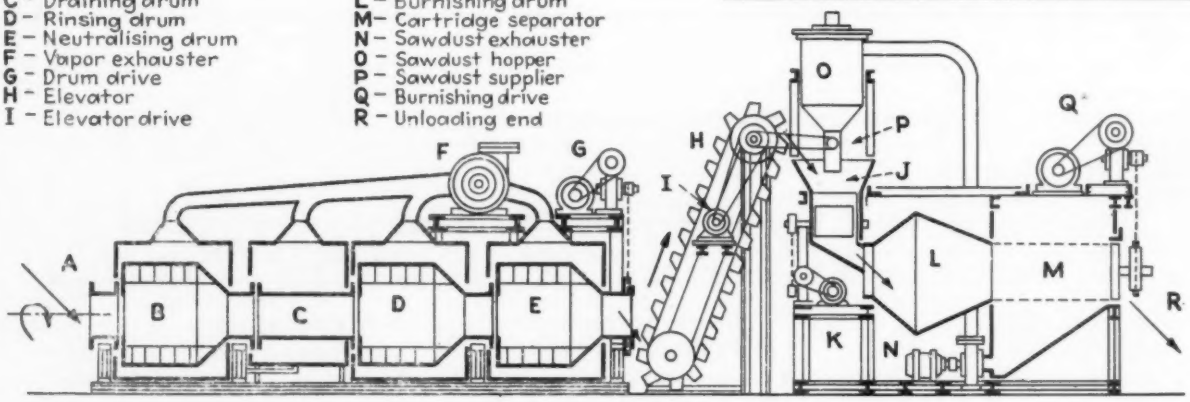
Work loaded in the top drum of this twin revolving machine is washed and fed to the lower rinsing drum. This arrangement conserves floor space for limited operations. Other stages may be added by using tandem drums but at a cost of floor space



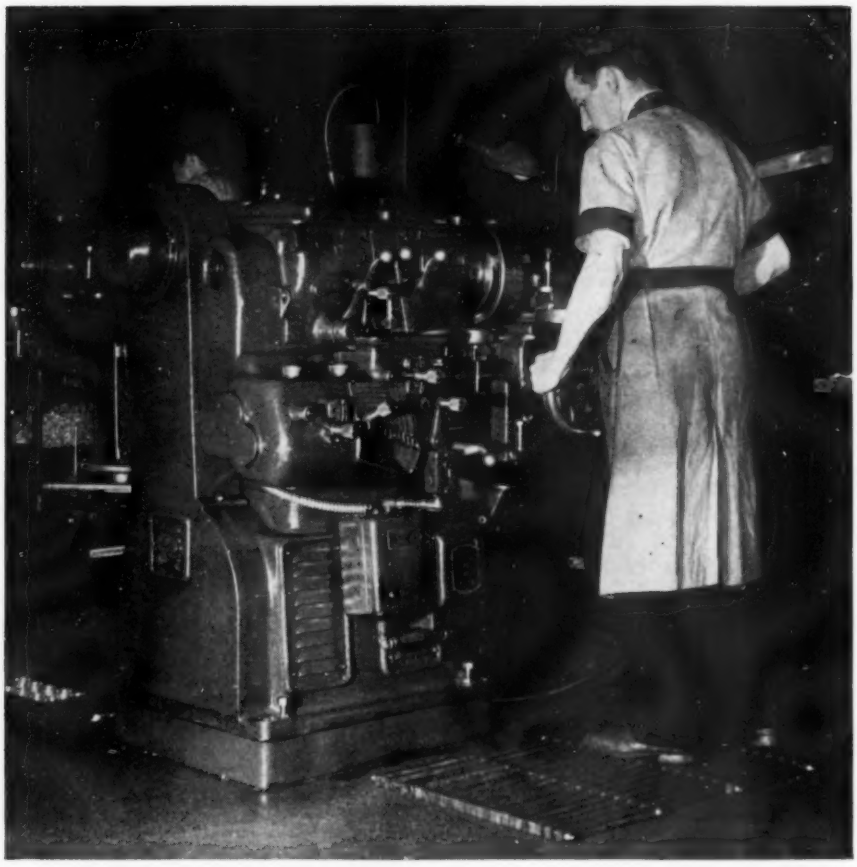
A – Shells
B – Hood
C – Washing section
D – Rinsing section
E – Drying section
F – Washing pump
G – Rinsing pump
H – Washing solution strainer
I – Rinsing solution strainer
J – Platform
K – Platform drive
L – Drying device
M – Vapor exhauster
N – Loading point

Large parts are easily handled by rotating platform machines. Several stages may be incorporated by limiting the area of each loading sector. The machine loads and empties at one position at floor level

A – Loading end
B – Pickling drum
C – Draining drum
D – Rinsing drum
E – Neutralising drum
F – Vapor exhauster
G – Drum drive
H – Elevator
I – Elevator drive
J – Cartridge mixer
K – Mixer drive
L – Burnishing drum
M – Cartridge separator
N – Sawdust exhauster
O – Sawdust hopper
P – Sawdust supplier
Q – Burnishing drive
R – Unloading end



Complex machines may be constructed to handle a variety of treatments. Here a revolving drum machine for pickling, dripping, rinsing and neutralizing is combined with a sawdust burnisher to complete the cleaning operation



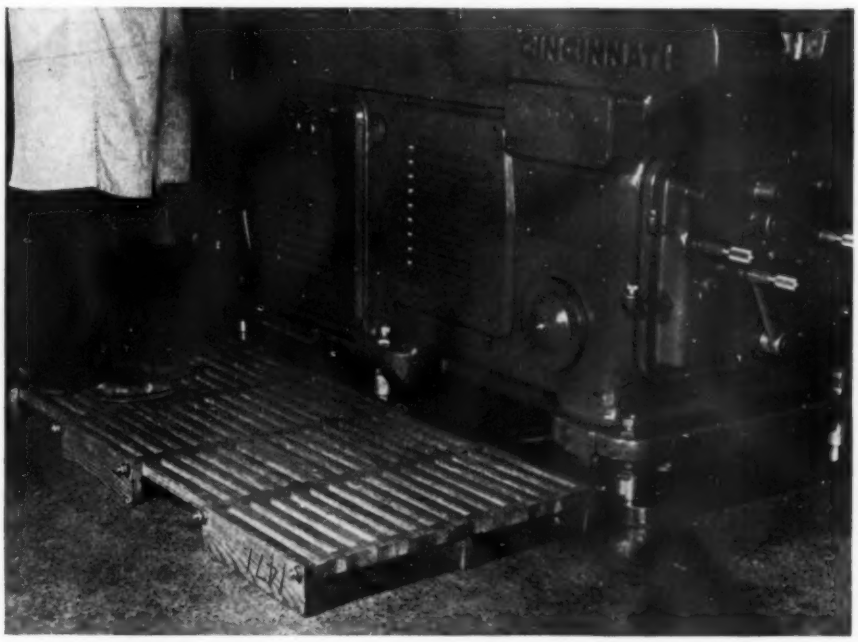
TALL OPERATORS working at standard height machines must bend to reach the controls. They are tired long before the end of the shift and go home with aching backs. Naturally their efficiency drops as fatigue and discomfort increase.

Designers of most modern machine tools plan their controls for easy operation by people of average height. This fact works an unavoidable hardship on tall operators unless something is done about it. Many of our operators are six footers and to make them comfortable and efficient at their work we had either to shorten our operators or raise our machines. The latter seemed the more expedient.

To raise the machines, we placed 4 to 5 in. blocks under them. The blocks for cabinet-base machines were formed and welded to shapes matching the machine bases (see right). This was done to prevent accumulations of dirt and chips. Leg type machines, such as most turret lathes and old-style engine lathes, have solid blocks under each leg (see below).

Machines Raised To Match Men

BY IRL C. MARTIN, PRESIDENT, WOODWARD GOVERNOR COMPANY



SHORTER OPERATORS—and not all our men are giants—could in turn be inconvenienced by these raised machines if we did not provide an additional means of adjustment for them. In front of each machine is a grilled maple platform on which the operator stands. With all our machines adjusted to the height of our tallest operators, we adjust the height of this platform to bring shorter operators up to convenient working level. This adjustment is made by the addition of wide strips or legs, as shown at the right. If an operator is transferred from one machine to another he takes his own platform with him.

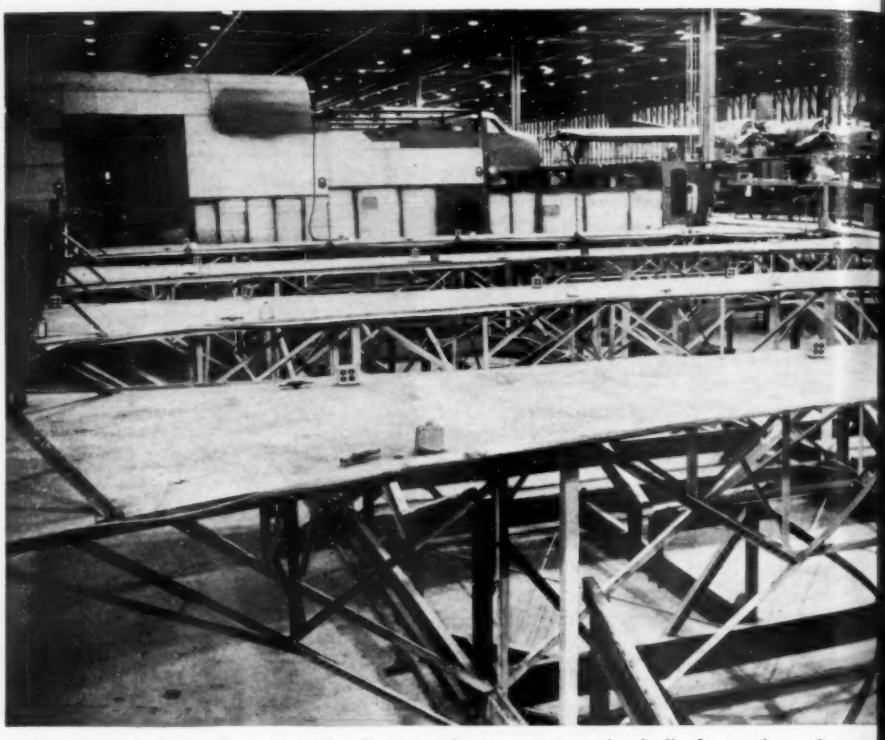
Final Assembly of the Coronado

CONSOLIDATED'S patrol bomber, the *Coronado,* is said to be the largest airplane currently being built on a continuous assembly line. This four-engine ship has a wing spread of 115 ft. and a gross weight of 33 tons. Its speed is better than 200 miles an hour and its cruising range, fully loaded, over 3000 miles.

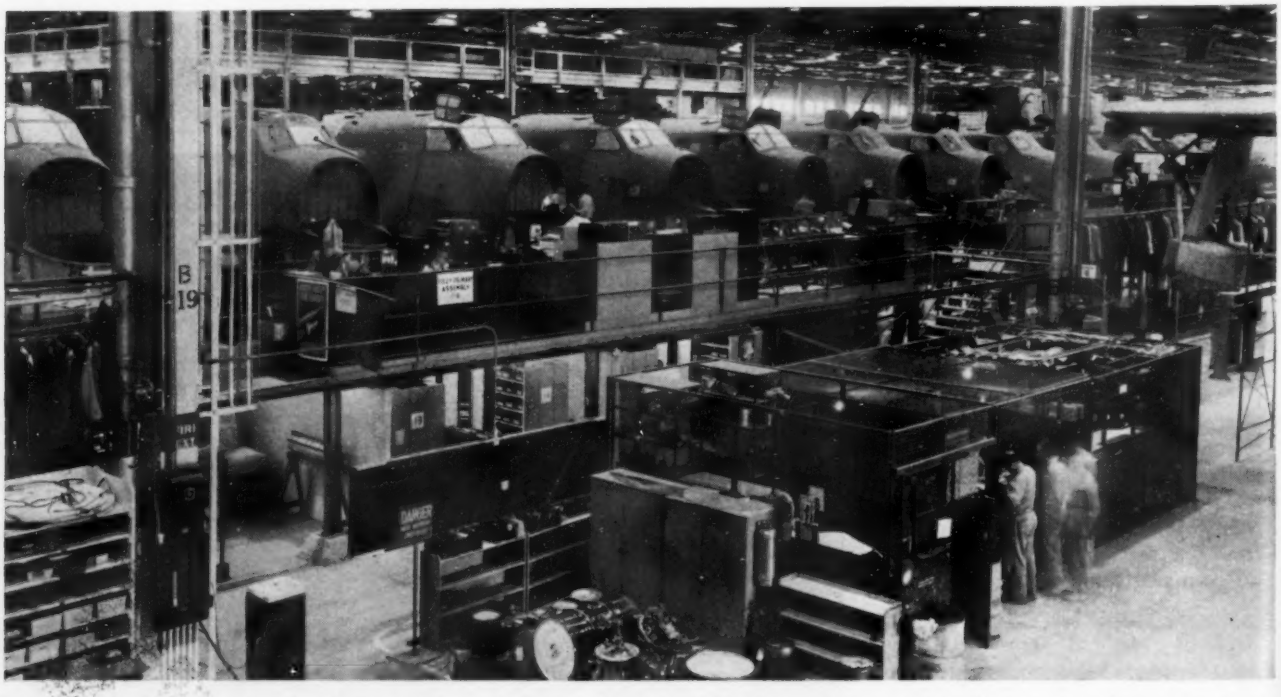
A unique feature of the *Coronado's* final assembly is the method of handling hulls. Their fabrication in hull bucks is conventional enough; the various subassemblies are fitted into place until the structural work is completed. On the final line, however, the hulls are loaded into cradles which move laterally to carry the assemblies through a series of work stations on a progressively moving line.

Work platforms integral with the cradles, move along with them at the bow ends of the hulls; these movable platforms are flush with a stationary platform that extends the entire length of the line. This platform supports racks which hold electrical and hydraulic equipment and other parts positioned conveniently at their points of installation.

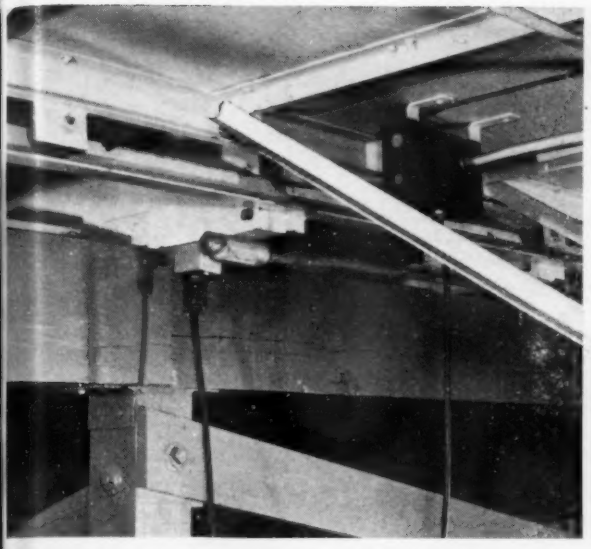
Some of the details of this method of assembly are shown here.



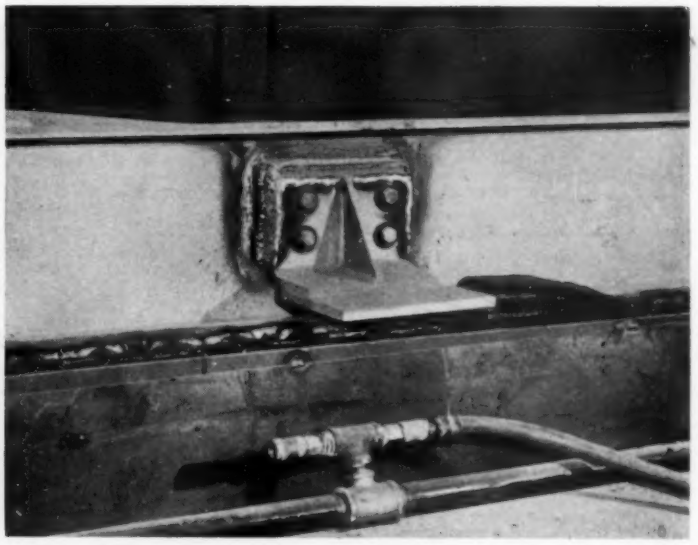
Roller-mounted cradles start the line ready to receive the hulls from the subassembly fixtures. They have chocks to support the hull and work-level platforms to facilitate the installation of equipment. Conveniently placed air and electric outlets are carried on each platform



The elevated stationary platform stretches along the length of the line, flush with the moving platforms which fit between the hulls and are carried along with them. Work racks at each station provide parts and subassemblies at the point of installation



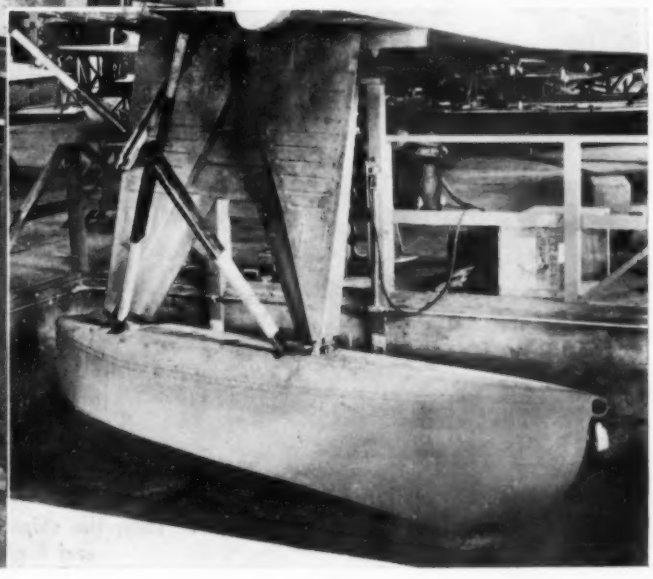
Work cradles roll along two tracks on the floor and a third track (shown here) on the stationary platform just beneath the point where the moving platform meets it. One plug feeds the wiring system that distributes current to twelve quadruple outlets on top of the platform

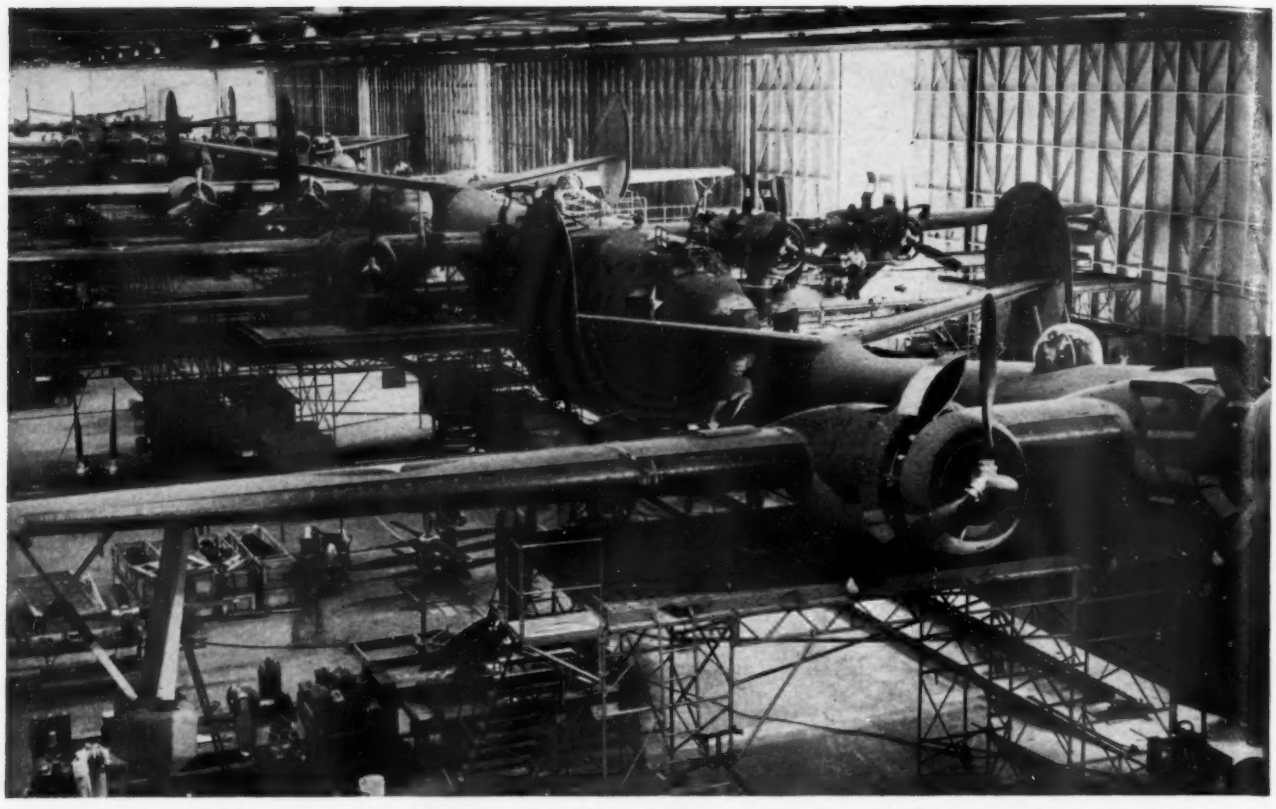


Cradles are moved intermittently by means of a pick-up block attached to a continuous chain driven by a 3-hp. electric motor. The block pushes against an angle iron bolted and welded to the base of the cradle frame. Since all the cradles are linked together, this drive applied to the last one moves entire row

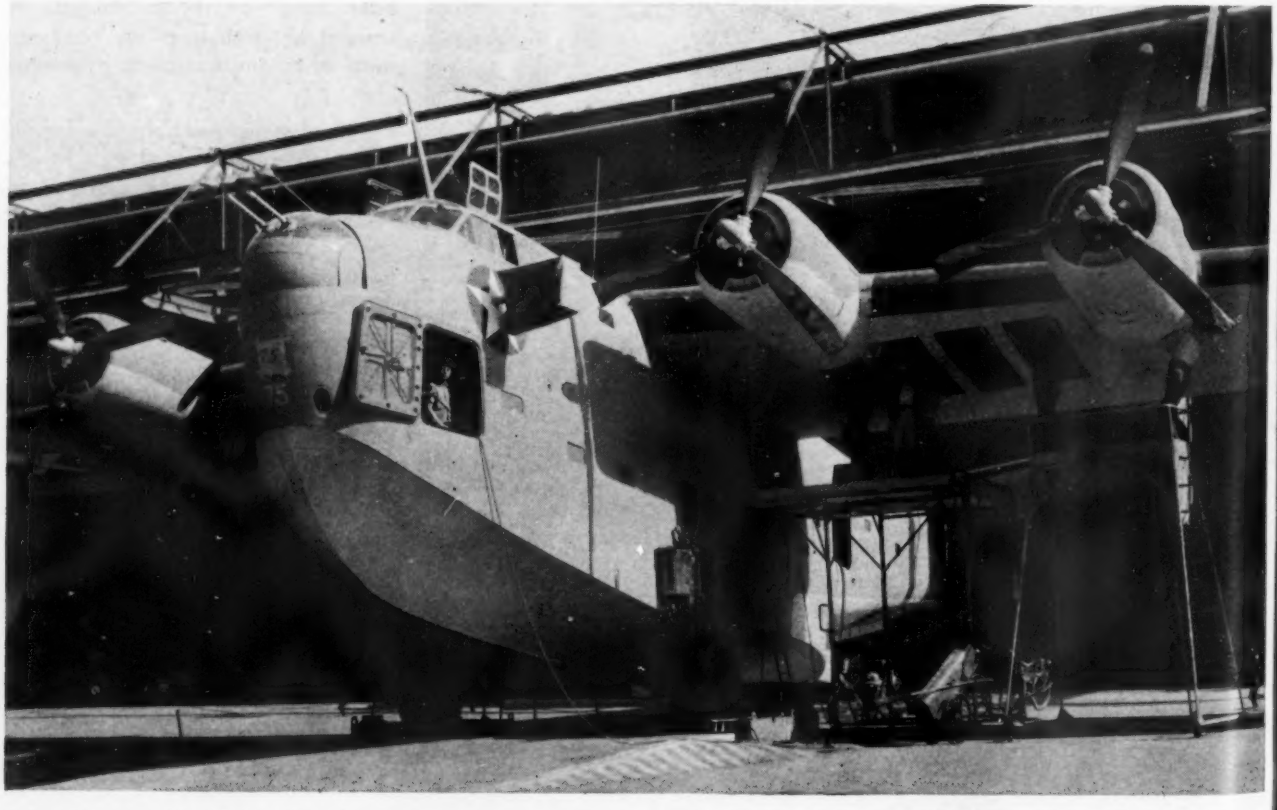
Beneath the stationary platform at the bow of the *Coronado* hull are shelves for holding small parts, fittings, rivets, nuts and bolts. This is the reserve which supplies the work racks on top of the platform. Colored disks hung on hooks record the amount of each item on hand and warn when the minimum is reached

The final wing assembly line for the *Coronado* has five stations. At station 3 (below) pits are provided for the installation of the wing tip floats. Similar pits at station 5 permit operation and inspection of the raising and lowering mechanism





Hulls are mated with wings and enpennage assemblies at the start of the final line. Here the last of the equipment is installed and the ships receive many operational tests and inspections. Fabricated tubing platforms provide convenient working positions



The last assembly station for the *Coronado* is outside the building. Final checks are made on all operating parts of the plane that affect its safety in flight. Then the ship is towed down a ramp on its beaching gear for launching and flight tests

Concave Surfaces Can Be Milled

BY CHARLES HAVRANEK

Apparently correct angular setting of the milling cutter for machining concave cylindrical surfaces of large radii on narrow work causes errors. These can be found and eliminated

IN MOST CASES where it is required to machine a concave cylindrical surface of large radius on work of relatively small width, the method of mounting the work on special faceplates or fixtures and turning on the lathe is costly and cumbersome. A simpler method is to use ordinary circular milling cutters set at an angle to the work.

When this was first attempted, the setting of the milling cutter was made by trial and error, using templets. Obviously, this method would be of much greater value if the cutter angle for milling a particular radius with a cutter of known diameter could be predetermined and the errors involved calculated. The three formulas given here were developed with that object in view.

The approximate setting of the cutter, as shown in Fig. 1, can be determined from the formula

$$\sin A = r/R \qquad (1)$$

where r = radius of the milling cutter, in.; R = radius required on the work, in.; and A = cutter angle, deg.

Since the surface resulting from a tilted cutter is cylindroidal, as shown in Fig. 2, and not cylindrical, formula 1 has definite limitations because the cutter setting will produce the error shown in Fig. 3. This error is a function of three variables: (1) the cutter diameter, (2) the cutter angle, and (3) the ratio of work width to cutter diameter. To find the error under any known conditions of the three variables, use the formula

$$E = r\left[\frac{\sqrt{1 - n^2 \sin^2 A} - 1}{\sin A} + \sin A(1 - \sqrt{1 - n^2})\right] \qquad (2)$$

where E = error, in.; and n = (width of work, in./cutter diameter, in.)

It is apparent from formula 2 that for fixed conditions of n and A, the error varies directly as the radius. Since n is constant and r varies, the width of work also varies as the radius of the cutter. Therefore, the error varies as the width of work and the practical effect of r in the formula is nullified. The most important factor in the formula is n. The errors involved for varying conditions of n, using a 6 in. diameter cutter and holding A first at 14½ deg. and then at 30 deg. are

n	Error, in. A = 14½ deg.	Error, in. A = 30 deg.
⅙	0.0011	0.0019
⅓	0.0024	0.0040
½	0.0064	0.0105

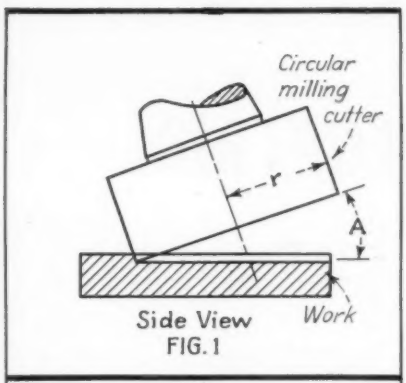
Other conditions when angle A is less than 30 deg. can be approximated from this table.

In practice, an error is involved in setting cutter angle A on the machine. This can be computed from the formula

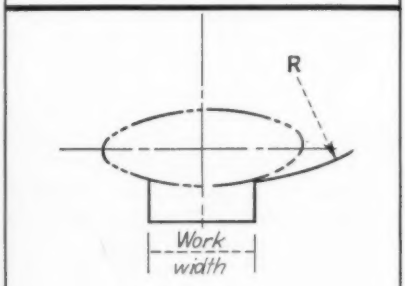
$$e = r\left(\frac{\sqrt{1 - n^2 \sin^2 A_1} - 1}{\sin A_1} - \frac{\sqrt{1 - n^2 \sin^2 A} - 1}{\sin A}\right) \qquad (3)$$

where A = cutter angle required, deg., as shown in Fig. 1; A_1 = actual angle set on the machine, deg. Therefore, $A - A_1$ = angular error in setting the machine, and e = error at the edge of the work due to the angular error in setting the cutter.

Error e can be used to some extent to compensate for error E in formula 2 by holding the angular error on the minus side. For example, on most machines the angle can be set accurately to within ¼ deg. Therefore, in setting angle A observe the following limits: A + 0 deg. minus ¼ deg. In practice it is a good rule to choose a cutter the diameter of which is greater than three times the width of the work.



Side View
FIG. 1



End View
FIG. 2

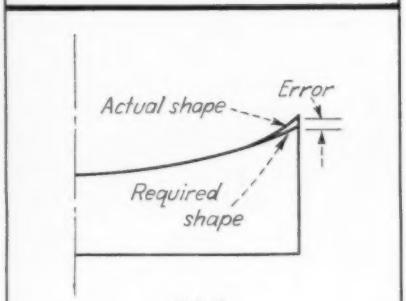


FIG. 3

Hand Stoning Tools

THE OLD MACHINIST always carried an oilstone slip in his pocket. This was particularly true of the toolmaker. He used this carefully on reamer cutting edges and on similar tools. This was when tools were ground by hand.

Then came the tool grinding machine and the idea of touching up by hand sort of fell into the discard. But with the coming of carbide tools the condition of the cutting edge took on more importance.

Makers of carbide cutters tell us that proper "stoning" of cutting edges greatly increases the life of cutters and also makes a marked improvement in the surface of the work. But instead of using the old fashioned oilstone they now make artificial stones of a fine abrasive with diamond dust as part of the mixture. Users of present-day tools would do well to learn the methods now recommended by makers of carbide as well as high-speed steel cutters.

Instructors are drawn either from outside the company or, where available, from among the employees. In some instances it is necessary to combine the plans, with several employees lecturing on various parts of the course

A Tailored Training Program

BY B. H. SALTZER, WRIGHT AERONAUTICAL CORPORATION

The time, the place and the manpower are all important factors to consider—along with a score of others—when planning an industrial training program

TRAINING COURSES for specific jobs are used by the Wright Aeronautical Corporation. This company has evolved a system for deciding whether any particular course should be given, who should attend, where the classes should be held and what are the most suitable hours. The entire project is handled by an educational division established under the supervision of the personnel department, whose main functions are: (*a*) conduct of the training program; (*b*) placing employees in touch with available courses, and assisting and advising them generally on educational matters; and (*c*) working with internal functional groups requiring supplementary training and procuring such special means as a study of each situation may indicate.

A special course of study may be requested by a responsible company source or by a group of individuals. In the latter case the requests usually come separately from employees seeking means for self-improvement, and when a reasonable number of requests has accumulated for a specific subject the head of the department or group whose work is involved is called into conference, so that he may be acquainted with the fact and understand what has been done for similar groups. If this conference develops that there exists a definite problem which experience indicates can be solved by proper training methods, the group head is asked to submit a written request as item number one in the file for the course. Conditions contributing to this need may be summarized as follows:

1. A large number of inexperienced new employees is being assimilated;
2. Only a minimum of supervision is available;
3. More people must soon be advanced to supervisory positions without adequate background, or the time or opportunity to develop experience on the job;
4. Job specialization has so narrowed the field of the individual worker that flexibility of operation is threatened;
5. The labor market can no longer supply experienced people to an organization which previously had no need to concern itself with training;
6. Expansion has so complicated the organization that new systems must be devised and put into operation without adequate time for explaining them;
7. Because of lack of basic background, absurd errors are made by people working at unfamiliar jobs;
8. Groups are being absorbed whose members have good theoretical background but need concentrated doses of specific job information to make possible the application of their theory;
9. Ambitious subordinates are exerting definite pressure on the group head;

With the decision made to organize a course, the first step is to determine whether there is a suitable instructor available from the group itself. Usually there is, and where possible several prospective instructors are invited to participate in the preparation of the

course. Even though only one is to be appointed as the actual instructor, the observations made at the preliminary meetings by the various persons recommended serve as a useful guide in making the final selection. When only a single person is recommended, it must be assumed that he is qualified and the best choice available. Should there be no suitable person available the usual procedure is to obtain an outside instructor to teach the general background material and to arrange for a number of different men within the group to give one or more short talks on his own particular phase of the work, tying it in with the general material. Often the men qualified to act as instructors are so burdened with their normal work that it is impossible for them to devote the necessary time and energy to handling an entire course, yet they may be able to find time for one or two talks.

Outline Is Important

The next step is to prepare an outline of the material to be covered, by means of one or more conferences between the instructor and the educational division. Experience has shown that it is worth while expending considerable study and effort in this preparation. There may be disagreement between the supervisory personnel who must work with the product of the course, either concerning the actual course content or the extent to which it is practical to try to advance the student; that is, as to what degree of improvement is possible in the time available. Insistence on a well considered and carefully coordinated outline is therefore of prime importance as a protection against possible future difficulties resulting from misunderstandings as to objectives.

It has been found that the outline must be prepared in much greater detail when the students are working at different jobs than when they have the same working background, and it will vary also with the relative composition of the class regarding length of working experience; the mixed class requires substantially more analyses than a class composed of members from a common level of experience.

Serious consideration must be given to the question of the working schedule of the class. This will depend to a large extent on the department head who must decide whether the course is to be obligatory or voluntary. The total length of the course will depend on the amount of material to be covered, and the frequency of the meetings. It has not been found desirable to establish a fixed period of time, and then crowd the course into this. If the class is large it may be desirable to handle it in sections, provided there are enough instructors available, otherwise, the course may be given to a selected group, and repeated as often as necessary.

The location of the classroom is governed to some extent by the nature of the course; very often the materials necessary for instruction purposes are available only in the plant, and intramural classes must therefore be held. In most plants space is at a premium at the present time, but since, in many cases, equipment is operating 24 hours a day, either some method of scheduling its use for instructional purposes must be worked out, or the entire project abandoned. Generally speaking, outside classrooms have been found preferable, both from consideration of space and freedom from factory noise. When classes are held on company time they should, if at all possible, be held on company property so as to avoid any difficulties in transportation, time recording, and so forth.

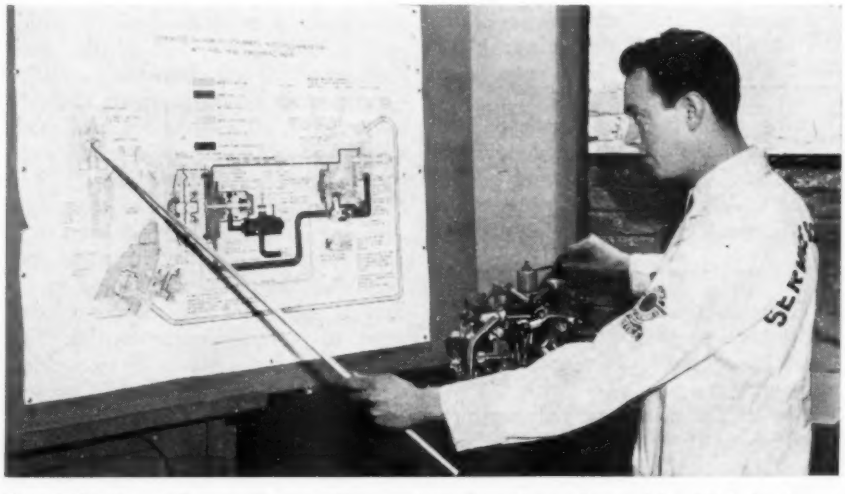
Refer Facts to Sponsor

The final step consists of turning over to the war training division of a sponsoring institution all the pertinent data, including the course outline, length of course, the proposed time, place, and frequency of the meetings, and the personnel record of the instructors, together with a request that it be submitted as a proposal. If accepted by the U. S. Office of Education, the department concerned will then work out the details of student registration, group the applicants into suitable sections, and notify them when and where to appear for class.

Experience has shown that courses jointly sponsored by the company and educational institutions are as a rule the best. By having course material examined by both the sponsoring institution and the Office of Education, many mistakes can be avoided. Furthermore, many courses can be made available which would not be considered sufficiently pressing to warrant operating and financing by the company.

In whatever way the course may be given, however, there are certain difficulties to be overcome. These will vary with each course, and each company, but may in general be:

1. Finding facilities and instructors for second shift workers;
2. Getting reasonable supervision of courses in operation to check: (*a*) The competency of the instructor; (*b*) adherence to the course outline; (*c*) adherence to the course schedule; (*d*) student attitude and interest.
3. Evaluating the benefit to the company and to the individual within a reasonable time after the course is completed, especially where the course handles a group whose individual work assignments are dissimilar;
4. Holding to a minimum the interference with production caused by the desire of large numbers of ambitious people to prepare for better positions, particularly when replacement personnel is difficult to obtain;
5. Controlling equitably the admission to upgrading courses of men with low draft classifications;
6. Resisting the widespread demand for advanced courses by individuals who have satisfactorily completed basic courses, but who are not eligible for advanced positions.
7. Securing the approval of superiors to the use of men in engineering positions for part time teaching.



Specialized training to fit specific needs is the plan adopted by Wright Aeronautical Corporation, to fit workers the more effectively into production. A company service engineer points out features of the carburetor during a lecture to a group of employees

Cage Chutes for Drawn Parts

BY ROBERT I. MINER, CHIEF ENGINEER, RYERSON & HAYNES, INCORPORATED

Made from four equally spaced steel rods held in position by rings welded at 12 in. centers, this design permits unrestricted passage of the cartridge cases

A LARGE DOUBLE CRANK PRESS had been fitted with dies for three stages of drawing 20-mm. brass cartridge cases. These dies were of the push-through type and the design contemplated the discharge of the part along curved channels in the bolster plate emerging in front of the press. This feature had not been fully tried out before the dies had been constructed and it was found that the radii of the channels was too small to permit the parts to flow.

Two possibilities of reconstruction developed: One, to drop the parts to the basement beneath the press from where they might be elevated by conveyors to the trimming operations which followed; the other, to design a type of carrier or chute to emerge from the press near the floor, thus allowing a design of chute with ample radii to insure against jamming in transit. A large tank for compound beneath the press somewhat complicated the first consideration; furthermore, it would not permit the drawing compound to drip from the cartridge cases, even when holes were drilled in the bases of the first channels. In addition, two heavy ribs in the press bed made curving carriers practically mandatory.

The so-called cage chute shown in the accompanying drawings was designed to take advantage of the small openings at the base of the press and near to the feet, to drain off compound to a pan below, and to use the power of the press stroke for propulsion. Incidentally, the effort required to propel the lubricated parts through these chutes for 15 to 20 ft. is so small in comparison to that exerted in forcing the parts through the draw dies that there is no apparent extra exertion of the press during operation. The parts flow in a smooth steady stream advancing one at a time to the next operation. Two other chutes of construction similar to the one shown in the drawings were designed for installation to transfer shells from dials Nos. 2 and 3 in Fig. 1. Such chutes were attached to the dies described in a previous article (*AM*—Vol. 86, page 1250). In other applications these chutes have conveyed parts over winding routes to hoppers, wash tanks, and belt conveyors.

Fig. 1 shows the front and left end of the press bed in plan and elevation. The opening from the die beneath Dial 1 and through the bolster plate lies on the right to left center line in the plan of the press bed. This drawing also shows the path of the shells from the die down through the bolster, up from the press, and finally to the table of the trimming machine for the next operation.

Select Chute Radii By Tests

The chutes are made from $\frac{5}{16}$-in. cold-drawn steel rods as shown in Fig. 2. Some preliminary experimenting should be done with a short section of the minimum radius which must be employed—or rather the largest radius permitted by the conditions—to determine the proper spacing, which should be close enough to confine the cartridge cases between the sides, and sufficiently wide to permit the easy sliding of the procession without allowing the "cocking" of any one case. The dimension of $1\frac{5}{16}$ in. inside diameter was found to be suitable by this method for a drawn case of $1\frac{1}{8}$ in. diameter and approximately $1\frac{7}{8}$ in. in length.

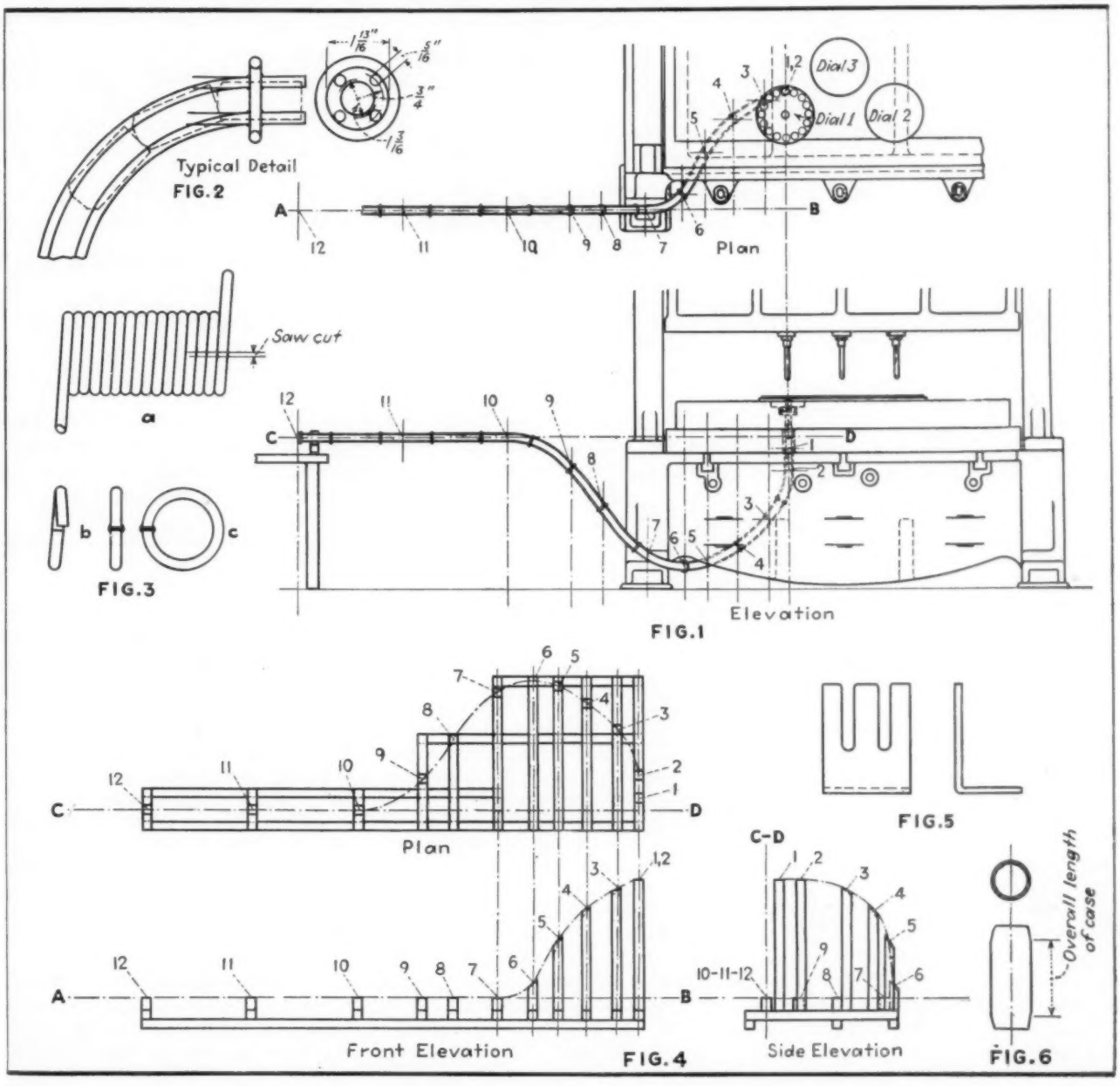
The retaining rings are welded to the rods and are spaced from 12 to 20 in. apart. They may be formed as shown in Fig. 3*a* by winding rods over a suitable mandrel in the lathe and sawing across one side. The individual rings will then drop off as in Fig. 3*b* from which form they may be straightened as Fig. 3*c*, and tack-welded. This also calls for some experimentation, but in general, the diameter of the mandrel should be sufficiently less than the inside diameter of the chute to allow for a slight expansion of the rings after being cut loose.

The next step in building the chute is to determine the path the parts are to follow. A fixture made of 2x2-in. lumber, as shown in Fig. 4, can be made for bending the rods and for holding them in position for welding and confining rings. The rods are bent to the smooth sloping curvature centerlined by the top centers of the posts, using an electrician's conduit bender. Two nails in the top of each post and a clamp at the starting point served to guide the rods. There is a slight difference in the lengths of arcs established by inside and outside radii, but if the rods are bent as suggested, the rings welded over them in positions about 12 to 15 in. apart, and a judicious use made of clamps and a successive application of the spacers shown in Fig. 5, it is a fairly easy matter to correct these discrepanices as the work proceeds. The clamps are used in pairs, one being applied at a right angle to the other. They are easily removed and reset, to permit slipping on the rings, as welding progresses. If arc-welded, precaution should be taken to prevent flash from reaching the inner surfaces of the rods from where it must be removed by filing and polishing with emery strips.

To make a layout for a fixture such as shown in Fig. 4, one may proceed by comparing like points marked on Figs. 1 and 4. It may help to visual-

ize the set-up by imagining the flat portion of the chute as being built on the inner face of a fence erected slightly back of the vertical plane passing through the line *A-B* of the plan view of the press in Fig. 1, and perpendicular to the floor. For further reference, a second horizontal plane is passed through the axis of the straight section (it might be called a ceiling), and extended to the right as traced by the line *C-D* in the front view. The imaginary fence and ceiling together with the chute are laid backward on the floor, and by reference to Fig. 4, it will become obvious that the height of the posts is determined by the distances from the plane *A-B* to the points back of it in the plan view of the press in Fig. 1 (back from the fence). The positions of these posts in the plan and front elevation of Fig. 4 are on the lines representing sections by planes perpendicular to the reference planes passing through the selected points *1, 2, 3, 4, 5,* and *6* in the compound curve in Fig. 1, and their spacing transferred to Fig. 4. The distances the posts are set back in the plan view of Fig. 4 are obviously those from the plane *C-D* (down from the ceiling), and transferred from the elevation of the press in Fig. 1. Smooth curves passing through these intersections determine the center line of the chute, and the tops of the posts are sloped to carry out the contour. The posts should be braced in position, but this has been omitted for clarity in the drawing. All corresponding points in Figs. 1 and 4 have been marked alike by numbers from 1 to 12, inclusive.

After building, the chute must be tested throughout its entire length. The plug shown in Fig. 6 is used for this purpose. It is passed through



This chute was designed for conveying 20-mm. cartridge cases from drawing presses to other points in the production line without manual handling. It consists of four equally spaced cold-drawn steel rods held in position by steel rings located at 12 to 15 in. centers. The rods are curved to the desired radii by bending around a fixture made from 2x2-in. lumber

the chute, and any obstruction to its passage is noted and corrected by adjusting the spacing of the rods. A large monkey wrench or an 18-in. bar with a slot at one end $\frac{3}{8}$ in. wide and 1 in. deep works well for altering the curvature. However, care must be taken not to mar the inner surfaces of the rods. Before installation, the chute should be tested with a full load of cases, each of which has been lubricated to conform to its condition when it leaves the press. A man should be able to move 15 to 20 ft. of cases by hand without undue effort.

The assembly of the chute to the base of the die must be determined by operating conditions. The method we used is shown in Fig. 7 and was applied to the die described in a previous article (*AM*—Vol. 86, page 1250). The funnel is shaped to receive the cartridge cases as they drop from the punch, and it is anchored to receive the end of the chute directly below the opening in the die and bolster. After installation in the most desirable position, suitable anchorages can be added. After the chute has been placed in operation and it becomes filled, one shell drops off the discharge end for every stroke of the press.

While this particular chute has been specifically designed for handling 20-mm. cartridge cases in the cupping and drawing stages, it is readily applied for conveying cylindrical drawn cases and shells of all sizes.

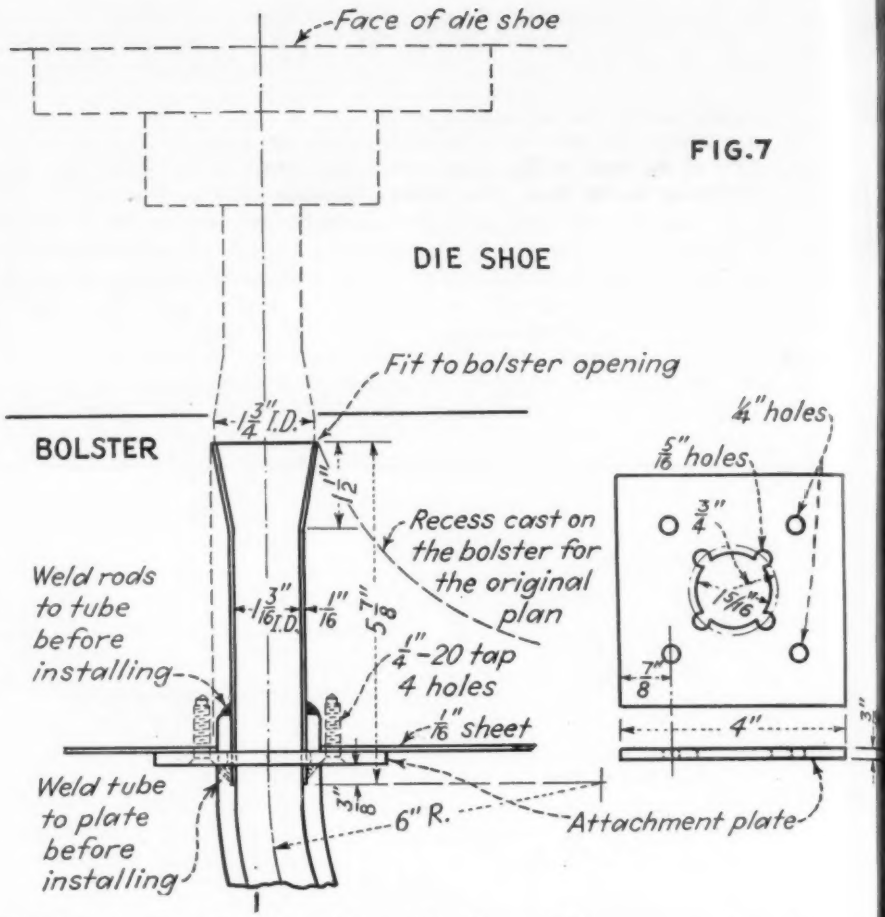


FIG.7

The chute begins with a funnel to receive the cartridge cases as they drop from the punch. After the funnel is bolted and welded below the opening in the die and bolster, suitable anchorages are added to hold the chute in the position that permits unrestricted passage of the cases

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SOAP SERVES THE SHOP

AS EVERY MACHINIST should know, humble soap does a lot more than get the grime off his hands, stop "B.O." or preserve that schoolgirl complexion. It's no mere beauty preparation. It's a hard-working shop hand, helping to keep the wheels turning, tools cutting, dies punching, and war goods pouring off our assembly lines.

In the battle against friction and high operating temperatures, soap serves in the front line. It is a vital ingredient in many lubricants; its emufsifying, lubricating, and jelling properties exceed those of any other single product. Many greases consist simply of petroleum oil and ordinary soap, the soap acting to solidify the oil and to help it stand up under heavy wear. Special lubricants, such as those used on parts exposed to gasoline, are made of mixtures of graphite and soft soap, or castor oil and soap.

Soap serves in cutting oils to save power, to save wear on critical tools, and to improve the finish on machined surfaces. The common emulsion-type coolants consist of mineral or fat oils emulsified in water. The suspension is stabilized with soap. The more expensive soluble oils, which remain transparent when diluted with water, also make use of soap as a solubilizing agent.

Soap serves at the punch press. Anhydrous soap is one of the best lubricants for deep drawing mild steel, aluminum and brass sheet. In one recently patented die lubricant, stearic acid and borax combine to form a small but significant amount of soap.

In drawing wire at high speeds, a penetrating lubricant having a high heat capacity is required. These conditions are best satisfied by emulsifiable oils, and again soap serves. It emulsifies the oil, increases the wettability, and acts as a lubricant itself. When a suspension of ferrous oxide and calcium soap is used in a soap solution, a highly polished, durable, rust-preventing coating is given the wire.

When the product finally nears the shipping room, soap still serves to keep valuable metals clean, to eliminate tiny "infection foci" in the surface, to prevent rust formation and corrosion. Practically all polishes contain soap to emulsify and suspend oil and metal dust and to act as a lubricant, and soap-building chemicals to extend the life of the polish.

And so soap's uses run on and on. It is used before, during and after electroplating; it helps in the electrodeposition of rubber; it is added to steel quenching baths and to the flotation method of mining copper, lead, tungsten, tin, iron, and other ores.

Side by side with the soldier in the field and the worker at his lathe, soap serves.

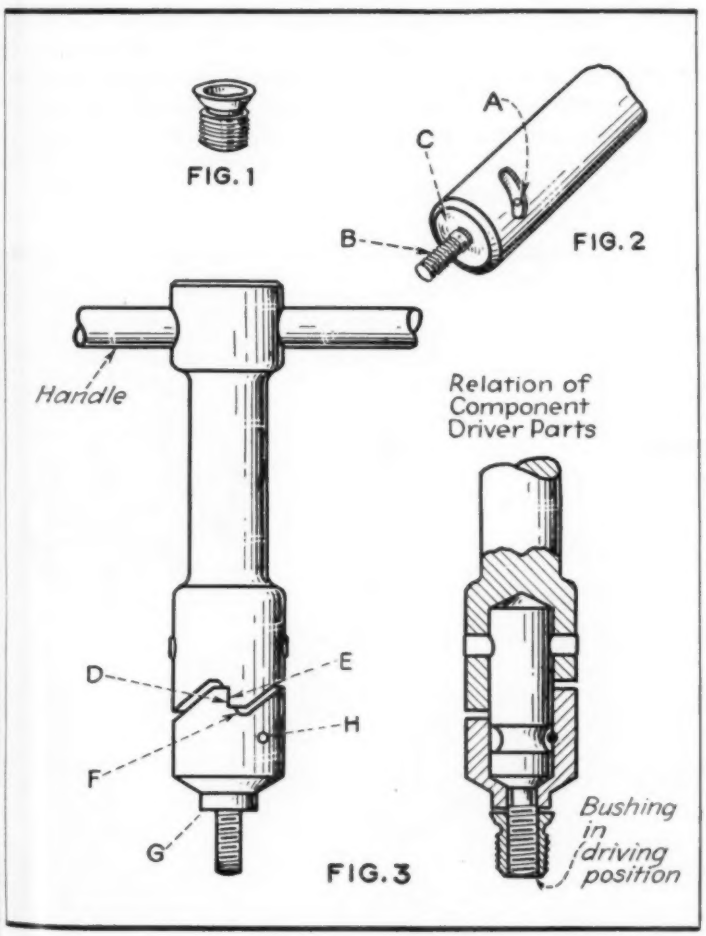
War Winning SUGGESTIONS

The following ideas were selected from those recognized as meritorious by the Board for Individual Awards, War Production Drive. They are freely offered to industry as an aid to its war production.

Bushing Driver Eliminates Damaged Threads

Where bolts that must be removed and replaced in teardown operations are driven into aluminum castings of Rolls-Royce engines, a screw bushing of either bronze or steel, as shown in Fig. 1, is first inserted to eliminate undue wear on the soft threads in the aluminum and a resulting loose bolt. When threads in aluminum are damaged, it is customary to rebore and retap the hole oversize and insert a similar bushing.

Considerable difficulty has been experienced in obtaining a suitable tool to drive these bushings. The one most generally used is the bayonet-lock type shown in Fig. 2, in which pin *A* travels in an angular slot cut in the driver shank. The pin is connected to threaded shaft *B* which is free to move inside the shank. Rotary pressure on the handle causes the shaft to recede into the shank, pulling the top face of the bushing against face *C* of the driver. The full driving effort is taken by pin *A*, which frequently shears or jams, causing the bushing to back out when an attempt is made to remove the driver. In such cases, the threads in the casting are frequently damaged or the tightness of the bushing in the casting may be destroyed. The part must then be removed from the assembly line and an oversize bushing fitted. To eliminate this difficulty, the tool described has been replaced by the one shown in Fig. 3.

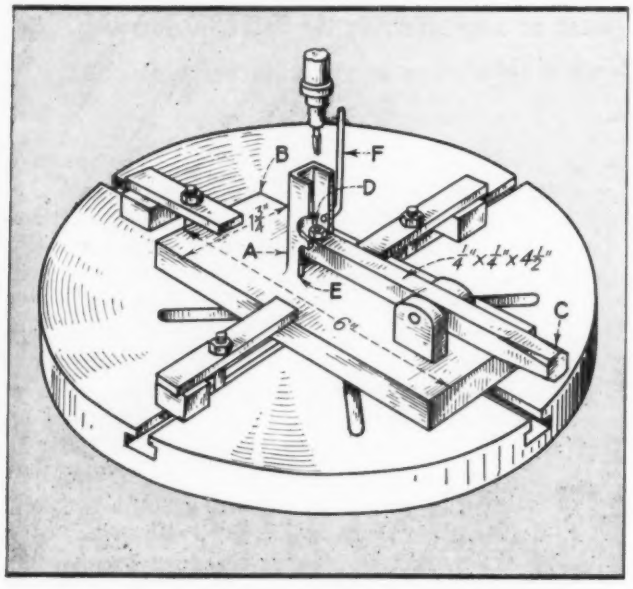


The new tool is a positive acting driver, consisting of a two-piece shank coupled by four jaws having mating angular faces. When the driver is not in use, faces *D* and *E* are separated and the angular faces are in contact. As the handle is turned clockwise, the lower faces of the upper half of the shank are forced upward to steps *F*, and the driving faces *D* and *E* also come into contact. The over-all length of the shank is thus increased, providing a seat *G* for the bushing head while it is being driven. After the bushing is driven home, the rotational direction of the shank is reversed and the two faces separate and return to their normal position. Face *G* is thus withdrawn from the upper face of the bushing, giving a clean release and leaving the bushing solidly in place. Pin *H* holds the loose lower section in place and limits its travel. With four jaws carrying the load on relatively large surfaces, there is no appreciable wear.

Fifty of these bushing drivers are now in use. There are no failures as with the tool used previously, four to six of which had to be repaired daily, keeping a toolmaker busy. This repair work is now eliminated, as are the repairs to damaged threads which caused production delays. In addition, special production orders to the machine shop for making oversize bushings have been minimized. *Suggested by Martin J. Brenner, Aircraft Engine Division, Packard Motor Car Company.*

Speeds Tapping of Small Nuts

The illustrated device was built to increase the speed of tapping small nuts. Channel iron *A* is welded to base *B* and serves as a guide for wooden lever *C*. The nut to be tapped is set on the end of the lever, which is tapered



slightly at *D* so the nut will be in a horizontal position while being tapped. The nut is kept from turning by the channel iron. Pressure on the handle end of lever *C* brings the nut against the tap chucked in a reversible spindle. When pressure is released after tapping, the spindle reverses and releases the nut, which is ejected automatically through slot *E* by a blast of air from hose *F*. A new nut is loaded manually. *Suggested by G. W. Yodes, International Business Machines Corporation.*

Sawing Time Cut From 8 Minutes to 10 Seconds

A subcontractor who makes parts for tanks was having difficulty sawing slots in electric cast-steel arm brackets. Excessive saw breakage was being experienced with a standard 6-in. high-speed steel saw of 0.125-in. gage having a ½-in. point. The saw, running counter-clockwise, took 8 min. for a 2½-in. cut at a feed of $\frac{5}{16}$ in. per min.

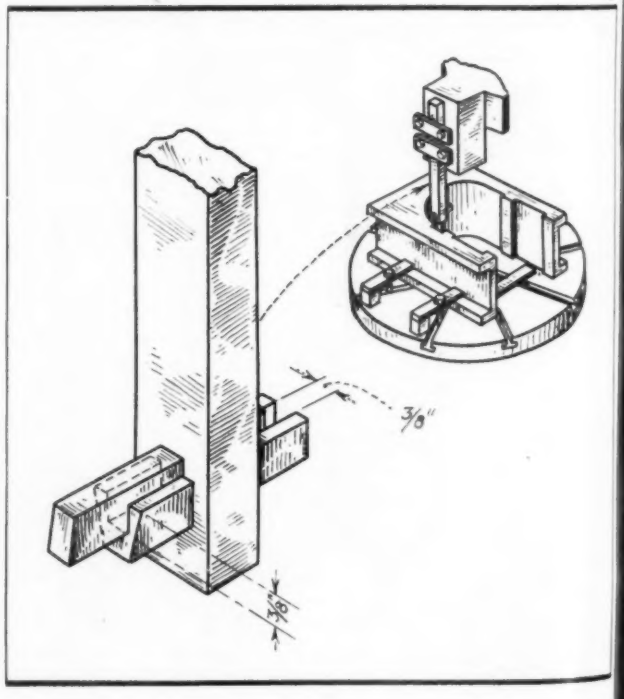
It was suggested that the saw be replaced by an Atkins No. 17 Curled-Chip tooth saw of 6 in. dia., 0.125-in. gage and having a ⅜-in. point. This saw, made of high-speed steel, is cup ground for clearance, and produces a curled chip which springs from the gullet as the saw tooth leaves the cut. It is used with a pair of special driving collars which are driven by three ¼-in. pins instead of a key, thus providing three points of evenly distributed contact and preventing strain.

It was further suggested that the saw be run clockwise, cutting up instead of down on the material, thereby retaining lubricant in the gullets and more readily throwing out the chips. The saw was run at 57 r.p.m. or 90 surface ft. per min., and the feed was increased from $\frac{5}{16}$ in. per min. to 15 in. per min. No blade breakage was experienced and cutting time on the 2½-in. slots was reduced from 8 min. to 10 sec. This performance has been repeated on other jobs. *Suggested by J. A. St. Clair, E. C. Atkins & Company.*

Holder Permits Use of Short Tools

When slotter tools are worn too short for clamping in the holder, they have to be reground for use on other machines. Then too they have to be ground to shapes for special holders. The illustrated auxiliary holder overcomes these limitations since standard tool shapes can be held in it, making it necessary to grind anly the auxiliary holder to the desired shope for the toolholder on the slotter ram. Furthermore, long tools, as well as short ones and toolbits, can be held under maximum clamping pressure.

Before ordinary slotter tools can be used with the illustrated holder, ⅛ in. must be ground from its width so that it will fit in the ⅜×⅜ in. slot; however, standard ⅜×½ in. toolbits have been used, since the auxiliary holder was first made. A number of slotter tools, regardless of length, can be sharpened and set up quickly. The tool extends ⅛ in. above the top of the holder to insure positive clamping when the setscrew is tightened. Cutting tools used with the auxiliary holder have given longer service than ordinary slotter tools. *Suggested by Harman H. Carlson, American Type Founders, Inc.*



SUGGESTIONS ★ ★ ★

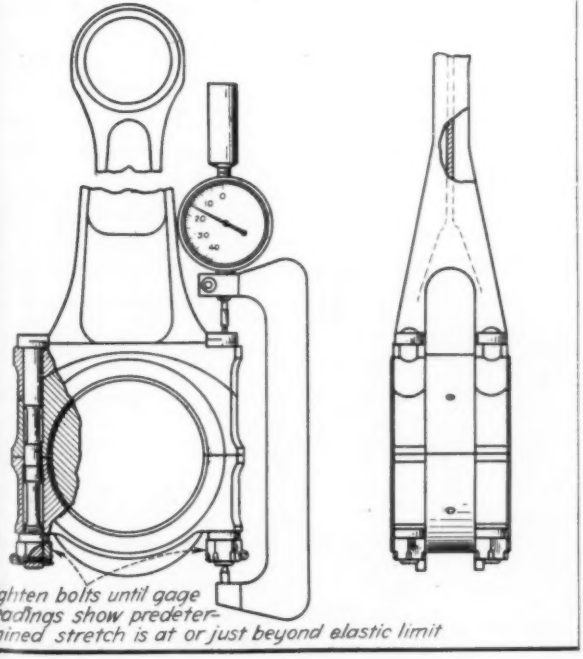
Dies Pulled Onto Trucks By Cable

When transporting dies from storage to the press department on trucks, the truckman has to slide the dies from storage shelves to the truck platform which can be elevated to the height of the shelf. When the truck cannot be backed against the storage racks because of narrow aisles, the truck cable cannot be used to pull the die onto the truck; therefore, it has to be done manually and, in the case of heavy dies, with much effort.

A hole can be drilled and reinforced in the side of the platform for insertion of a sheave. The truck cable can then be used to slide heavy dies sideways onto the platform. *Suggested by Harold F. Minor, International Harvester Company.*

Tightened Bolts Exceed Elastic Limit

Adequate and uniforming tightening of aircraft engine connecting rod bolts can be obtained by stretching them approximately to or beyond their elastic limit. Before developing means to accomplish this it was proved by repeated tests that bolts can be so stretched up to a certain maximum without harm. It was further ascertained that a positive and accurate degree of tightness may be secured by measuring the amount of stretch.



Tighten bolts until gage readings show predetermined stretch is at or just beyond elastic limit

Such a method is practiced in one aircraft engine with connecting rod bolts about 4 in. long having a $\frac{3}{8}$ in. body dia. and $\frac{1}{4}$ in. dia. at the reduced section. Since all four bolts in each connecting rod are of the same design, they will stretch to the same degree by a given pull. The indicator gage or extensometer used to measure the stretch is shown in the illustration. The anvil and spindle of the extensometer can be placed in the center holes on the bolt.

In the bolts shown, the stretch corresponding approximately to the elastic limit is 0.007 to 0.008 in. After tightening the four bolts to obtain that stretch, the combined preload is greater than the load carried by the rod when the engine develops maximum horsepower, while the load on each bolt is known to be the same as on the others, since each was tightened to the same gage reading.

Connecting rod bolts are usually secured by cotter pins; therefore, slots in the nuts and bolt holes must be aligned. The maximum tightening to obtain that alignment is one-eighth of a turn for a hexagonal nut, which will further stretch to bolt as much as 0.006 in. This added to the original stretch of 0.007 to 0.008 in., gives a total stretch of 0.013 to 0.014 in., which is well within the safe limit of 0.010 in. per in. of bolt length.

Since the adoption of this method, replacing the torque-wrench method, there has been no failure of connecting rod bolts. The method is adaptable to air-cooled as well as liquid-cooled aircraft engines. It has been adopted by one other aircraft engine manufacturer and is being considered by others with the prospect of universal adoption by the industry. *Suggested by William H. Graves, Packard Motor Car Company.*

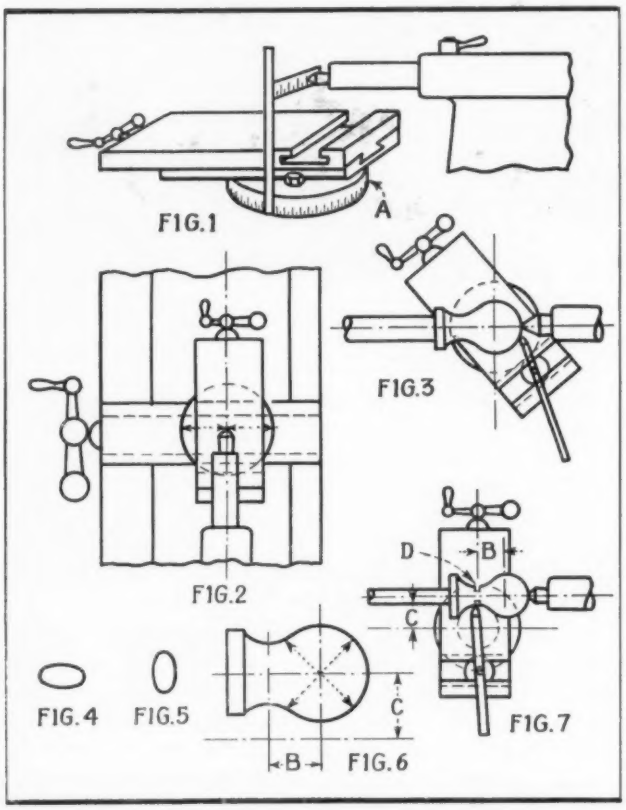
IDEAS FROM PRACTICAL MEN

Ball Turning On A Lathe

BY FRED J. ATZROTT

The principle involved in turning a ball on a lathe is the same as scribing a circle with a divider, since the center of the compound rest corresponds to the center of the circle and the cutting tool can be turned about that center. The necessary steps for turning the ball are as follows:

Find the diameter of bottom *A* of the compound rest with a caliper and extend the tailstock center until it is at the center of the compound rest—this location can be



When turning a ball on a lathe, the center of the compound rest should be in the same vertical plane as the tailstock center point. The tool can then be turned around the work in a circle

gaged by eye. Then using two scales as shown in Fig. 1, measure one-half the diameter of the compound rest to the extended tailstock center, and with the cross-feed handle move the compound rest until its center is in line with the tailstock center point. This position is shown in Fig. 2.

Run the compound rest to the extreme end of the screw as shown in Fig. 3, and place the tool in position. With the handle on the opposite side of the lathe as shown, full swing of the compound is possible. The tool can then be fed evenly and gradually around the workpiece, using a piece of pipe on the end of the tool should it be short. It is well to rough turn the corners from the workpiece before setting the compound rest central.

As soon as the workpiece has been machined and appears to be round, it should be calipered to see that it is not egg shape. If the ball calipers oblong as shown in Fig. 4, the compound rest is beyond the center. If it calipers as shown in Fig. 5, the compound rest is not up to the center. When the ball calipers as shown in Fig. 6, tighten the cross-slide and then finish the ball to proper diameter.

The reverse radius at the neck of the workpiece must now be machined. This is done by obtaining dimensions *B* and *C* from the blueprint, and moving the carriage forward distance *B* and the cross-slide back from center by an amount equal to *C*. The reverse radius can then be cut by adjusting the handle of the compound rest. Neither the cross-slide nor the carriage handle need be touched again.

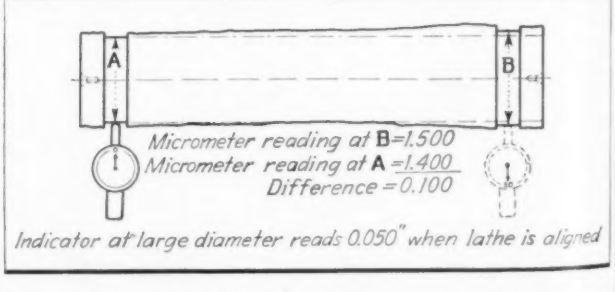
If a complete ball be desired, neck the workpiece at *D* with a parting tool. The slot should be small enough in diameter so that the ball-turning tool will make a complete half turn, and yet it should be wide enough so that the tool will not touch the left-hand side. The neck of the ball is finally sawed through and filed round by hand.

Long Work Aligned With An Indicator

BY RALPH R. WAECH

When the entire length of long work must be held to a close tolerance, and a test bar is not available for lining up the lathe centers, alignment can be attained with the aid of a dial indicator. However, the method presupposes that the leadscrew and cross-feed dial are in good repair and accurate.

First turn a smooth recess at each end of the workpiece, making sure that the depths of the recesses do not exceed the travel of the indicator spindle. Measure the diameter of each recess with a micrometer, and subtract the readings, which in the illustrated example is 1.500 minus 1.400 or 0.100 in. One-half of difference is 0.050, which is the



Long work can be held to close tolerance on the diameter by turning recesses at each end and checking alignment with an indicator

excess stock left on one side of the large-diameter recess. Mount the indicator in the toolpost, place the indicator spindle in the recess at the small diameter, and set the dial at zero. Move the indicator to the large-diameter recess and note the reading. If it reads exactly one-half the difference in micrometer readings, in this case 0.050 in., the lathe centers are in alignment and the work will be machined straight. If it does not read one-half the difference in micrometer readings, the tailstock can be adjusted until the desired reading is obtained.

Tool Drills Angular Holes

A device developed at General Electric's Schenectady Works for angle drilling and counterboring holes in joint surfaces can be adapted easily for similar jobs. It is comprised of an electric hand drill *A* fastened in frame *B* which slides on way attached to arm *C*. A geared mechanism with handles advances and retards the drill. Handle *D* is the rapid-traverse handle used for positioning the drill, while handle *E* is used to feed the drill when drilling and counterboring. Horizontal movement is made radially by arm *C* pivoting at center *F*. The arm travels on rail *G*, and when the correct angle to the work is obtained, a locking device between the rail and the arm holds the unit in position.

Adjustable table *H* upon which work *I* is placed has two guide blocks *J* for lining up the joint. A clamp holds the work on the table. The table can be moved vertically by cranking shaft *K*, and sideways by cranking shaft *L*.

Drill guides *M* are keyed and locked in position with the main body of the device. Each drill guide has a removable drill bushing *N* and a stop to locate the work correctly when the table is being moved sideways.

The following operational sequence is used: The work is moved against guide blocks *J* before being clamped to the table. The table is moved sideways until the work comes in contact with the stop on one of the drill guides. Adjustment of the table to correct height is then made. After the drill bushing is applied and the drill centered therein, the entire device is locked in position.

After drilling and counterboring the hole on one edge of the work, the arm is swung to the opposite side of rail *G*. The table is moved until the work rests against the stop on the second drill guide, where the second hole is drilled and counterbored.

Previously, this job was done on a drill press, but it was an awkward and insecure process. The work had to be positioned for each hole drilled, and an other undesirable factor was that the work extended considerably beyond the holding clamps, increasing the possibility of dislocation while machining.

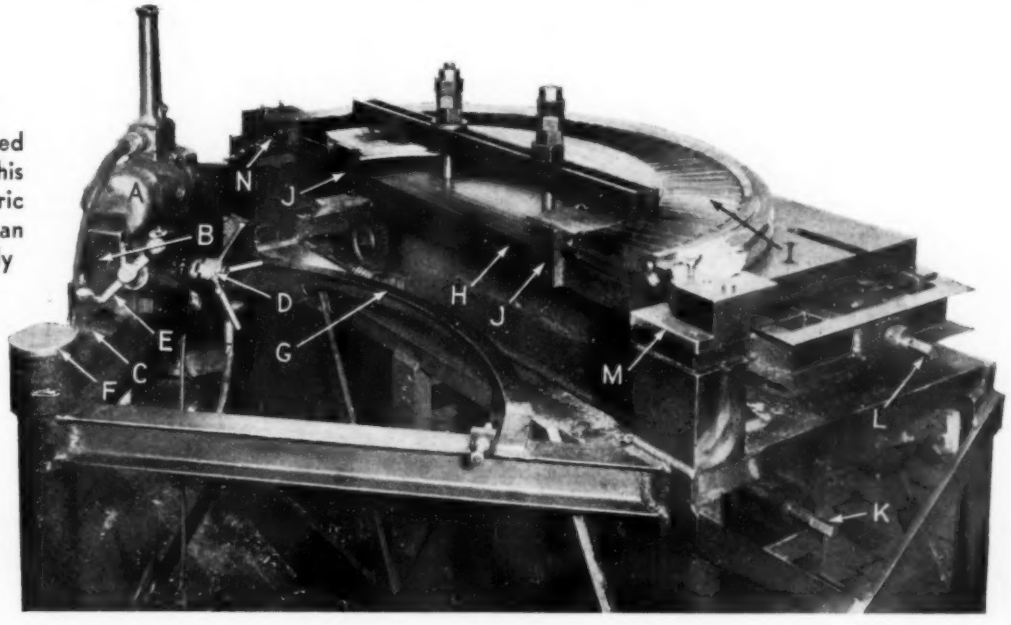
Minimize Backlash In Leadscrews

BY ORVILLE E. HYLER

Frequently, in production work, where one operation is set up on a machine and remains there indefinitely, causing the carriage or head to travel back and forth on a small portion of the bed, wear necessarily occurs on only a portion of the leadscrew, as well as on the nut. When that condition arises, the only remedial procedure is to remove the screw from the machine and rechase the threads, cutting them down until the same pitch diameter and thread thickness prevails throughout the length of the screw. After installing a new nut of the same diameter as the rechased screw, the backlash of the screw will be reduced to a minimum.

One way to retain this minimum backlash is through the installation of an auxiliary nut so placed that when the carriage or head is indexed toward the headstock, one nut takes the load, and when indexed away from the headstock the other nut takes the load.

This auxiliary nut should be held by a bracket bolted to either side of the carriage. Then as wear occurs between the screw and nut, the bracket can be shimmed away from the carriage, taking up the play. When taking up backlash with this arrangement, care should be taken to leave at least a couple of thousandths clearance, since too close an adjustment will result in excessive drag with a higher rate of wear.



Angular holes are drilled in the joint faces of this turbine part by an electric hand drill mounted on an arm that swings radially

Tack and Plug Welding Simplified

BY OSCAR CRAFT

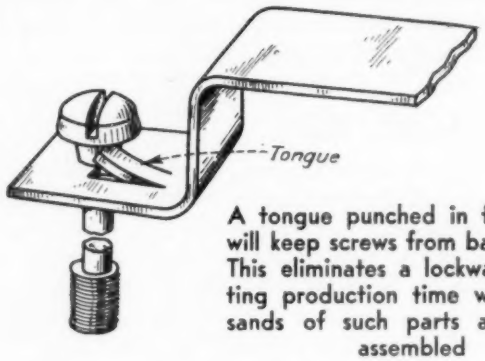
Production employees without previous welding experience can make tack welds or can plug weld small holes with the set-up shown in the drawing. The arrangement can be used for making a number of plug or tack welds on the same part, or a few welds on a number of parts.

Electrodes *A* are supported above the work by vertical $\frac{5}{16}$ in. diameter brass or steel rods *B* having clamp blocks *C* made of hard wood or other non-conducting material for holding the electrodes. These clamp blocks are arranged so that they can be adjusted vertically on the support rods and are designed so they will hold the electrodes at almost any angle. Each support rod is fitted in a separate metal base *D* which can be moved about on the metal top of the welding table to suit the requirements of the work.

The ground wire from the arc welding set is connected to the metal table top. The electrode wire from the welding set is connected to each of the electrodes with any suitable setscrew or spring connector. In setting up for plug or tack welding, the electrodes are positioned around the work piece or pieces, leaving a $\frac{1}{16}$- to $\frac{1}{8}$-in. gap *E* between each electrode and the work, the size of gap depending on the metal being welded and the size of weld required.

When each electrode has been positioned, the operator starts the welding set and turns on the current. He then takes an "exciter" *F*, which consists of a wedge-pointed carbon rod mounted on a wood handle with a metal clip, and touches the pointed end of the carbon between the electrode and the work in the gap *E*. This strikes an arc instantly, and the arc will continue long enough to complete the job required. When small welding sets are used, the first arc must be extinguished before the next arc is excited. However, with large-capacity welders, three or four arcs may be welding at the same time on the work.

With a little thought in making such set-ups, the time for each individual tack welding job may be reduced as much as ten times. Recently I spent only a few minutes explaining this scheme to a youth who had never used a welder. He then did a perfect, uniform job of tack welding on a number of pieces, at a rapid rate of speed.

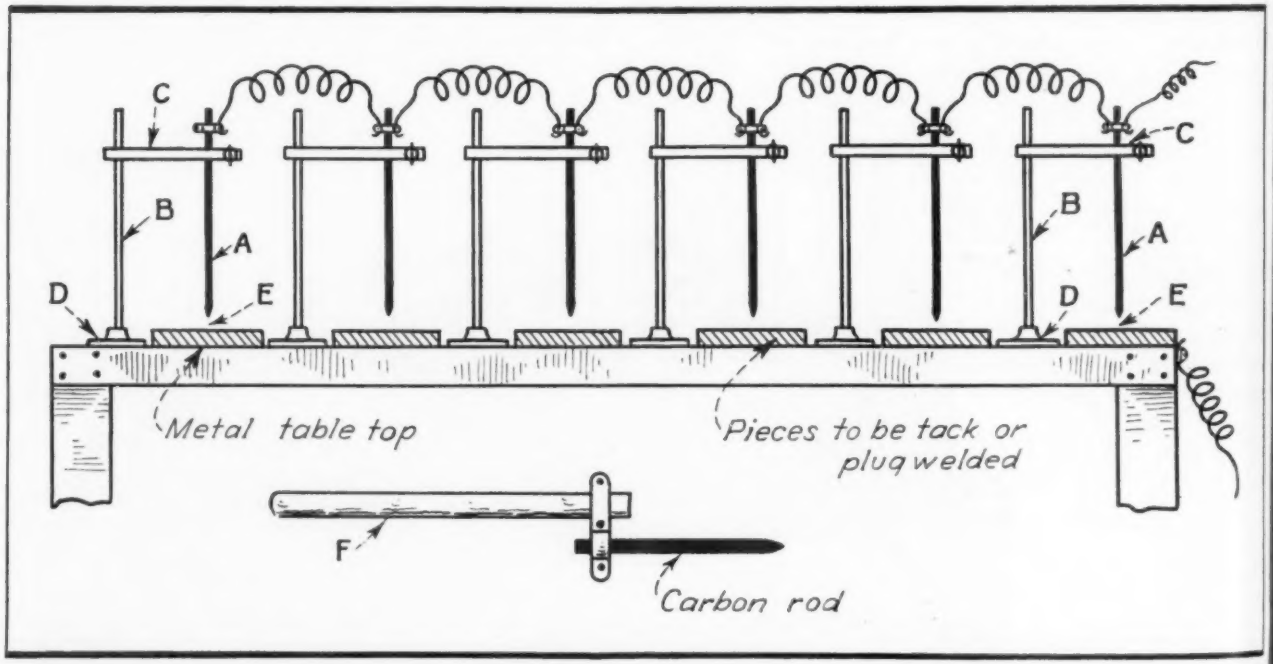


A tongue punched in flat pieces will keep screws from backing out. This eliminates a lockwasher, cutting production time when thousands of such parts are to be assembled

Self-Locking Terminal Assembly

BY T. C. DuMOND

When assembling electrical devices, which include terminal and many other small parts, it is conventional to use lockwashers under the heads of screws to keep them from coming loose. The lockwasher is an additional part which must be handled during assembly. In many assemblies, lockwashers can be eliminated by punching or otherwise forming a tongue on which the screw will set when pulled down tight. The tongue is so formed that when the screw is tightened it will lay flat under the screw head but will resist the tendency of the screw to turn out and become loose.

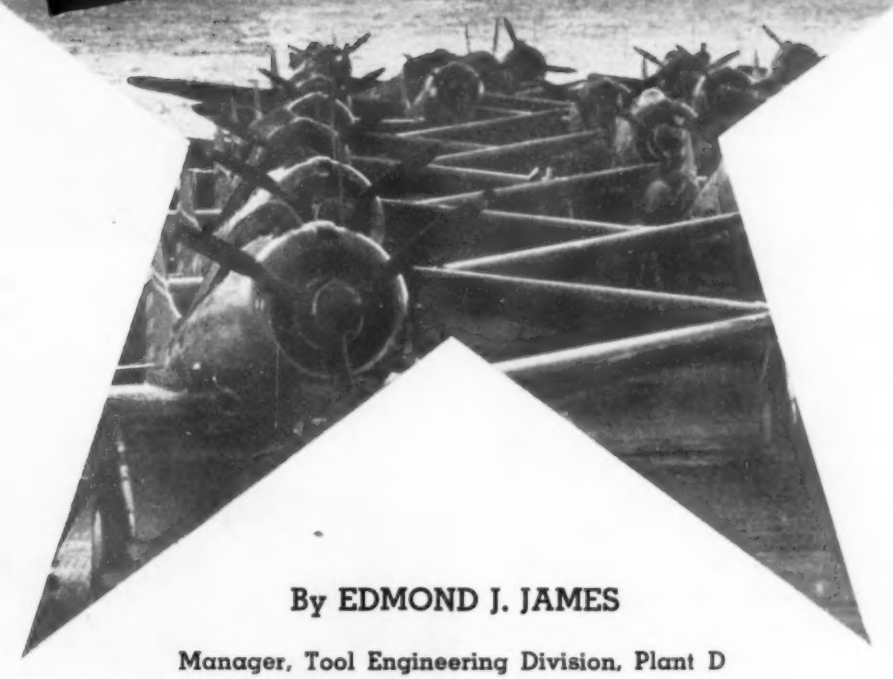


Tack or plug welding can be performed by inexperienced operators with this arrangement of mechanically supported electrodes arranged around the work for each weld

Armament

SECTION OF AMERICAN MACHINIST

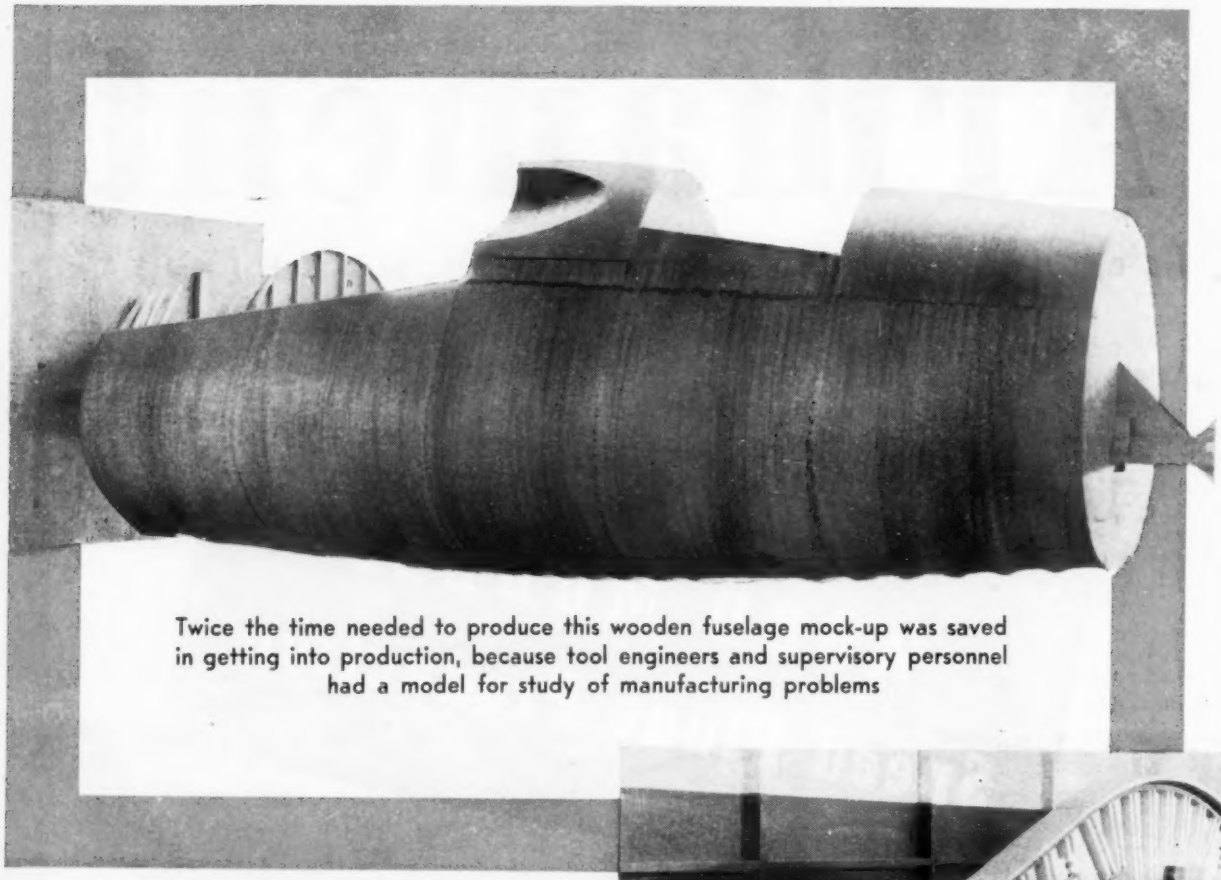
WOOD MODELS Speed Plane Production



By EDMOND J. JAMES

Manager, Tool Engineering Division, Plant D
Goodyear Aircraft Corporation

WOOD MODELS SPEED PLANE PRODUCTION



Twice the time needed to produce this wooden fuselage mock-up was saved in getting into production, because tool engineers and supervisory personnel had a model for study of manufacturing problems

A model of the main beam for the wing center section illustrates attachment points and construction details

EARLY IN 1942, the Navy Department signed a contract with this company calling for the manufacture of Vought-Sikorsky fighters. Monthly production schedules are necessarily a military secret, but it can be said that tooling up a plant ⅝-mile long has cost many millions of dollars.

At that time, the Corsair had not been built in mass-production quantities. Hence, in many respects, we were free to develop our own tooling methods, with the guidance and advice of engineers of Vought-Sikorsky and the Navy.

Unit quantities in plane and automobile manufacture are poles apart, but there is one feature common to both fields—the problem of assembling sheet-metal components with minimum repair effort; that is, hand fitting. Although we were under heavy pressure to get into production as rapidly as possible, every effort had to be made to insure the highest degree of part interchangeability yet maintain production speed and quantity. We had to get volume production and conserve labor as well.

In the Tool Engineering Division, as initially set up for this project, three of the key men had had extensive automotive experience. Therefore it was natural that they should bring to bear upon the problem their experience in making sheet-metal body stampings.

Engineering the complex wing center section assembly for mass production was facilitated by a wooden mock-up that includes the main beam shown above

Wood Mock-Ups

As the first step, a pattern shop was set up and wooden mock-ups built of the fusalage and wing center section for educational purposes. While construction required three months, it is estimated that these mock-ups saved at least six months in getting into production.

Our aircraft personnel came to us from many sources—Ohio body builders, Detroit auto plants and tool engineering offices, aircraft plants, as well as Goodyear rubber-manufacturing operations. So throughout the tooling period the mock-up has proved invaluable to tool engineers, fixture designers, plant-layout men and others in correlating drawings with finished proportions and dimensions of parts and subassemblies.

The fuselage mock-up is built in sections identical with the major subassemblies of the ship—aft section, midsection and front section. Each of these sections closely duplicates dimensions and contours of the corresponding plane subassembly. Internal ribs in each section are made of $\frac{5}{8}$-in. plywood (or equal in width to the flange on the metal rib) and spaced exactly at the proper "stations" along the longitudinal axis, or "thrust" centerline of the airplane. Mahogany panels, $\frac{3}{32}$ in. thick, are used for the skin panels.

Fuselage mock-up sections are fastened together with stove bolts and the whole suspended between two wooden endplates. Wires are run between the endplates to represent the horizontal plane at the centerline of thrust and the vertical plane at the centerline of ship.

These wires give a convenient method of checking distances from any point on the ship to the two reference planes. Later the mock-up was unbolted, so that sections could be used for shop study, plant layout, development of conveyor systems and similar studies.

A separate mock-up of the main beam and wing center section was also produced to present a picture of the manufacturing problems connected with this vital subassembly.

Both of these mock-ups were used constantly for reference purposes during the construction and positioning of production tools and fixtures. With the monthly quotas assigned by the Navy, our aim was to combine the best in proved aircraft and automotive production methods to produce aircraft components which would "fall together" at assembly, thereby avoiding the time loss of repair work or fitting.

We decided therefore to make full-size mahogany models of thousands of part-details—the 33 skins in the fuselage sections; the ribs or formers used in the fuselage sections and the wing center sections; the center section leading edge, main beam, and landing gear

Made to the inside of the skin, three templets are employed to check the vertical "stations," or coordinates of reference points, at the two ends and the center of the wood model for a reinforcement stamping used at the aft section of the fuselage

WOOD MODELS SPEED PLANE PRODUCTION

struts and drag links. These models serve a variety of purposes in both our tooling and production plants:

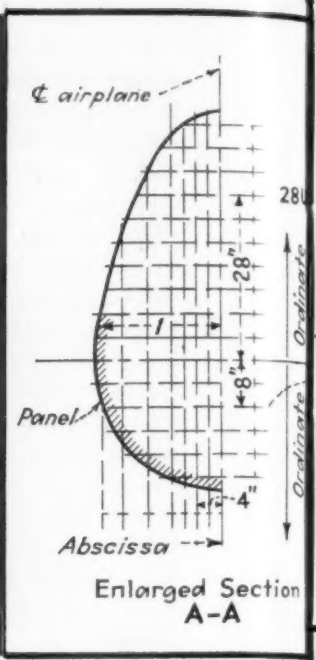
1. For building press dies for ribs and stretcher-machine punches for skins.
2. For making master parts.
3. For making drill jigs.
4. To act as production inspection devices instead of expensive built-up gaging fixtures.

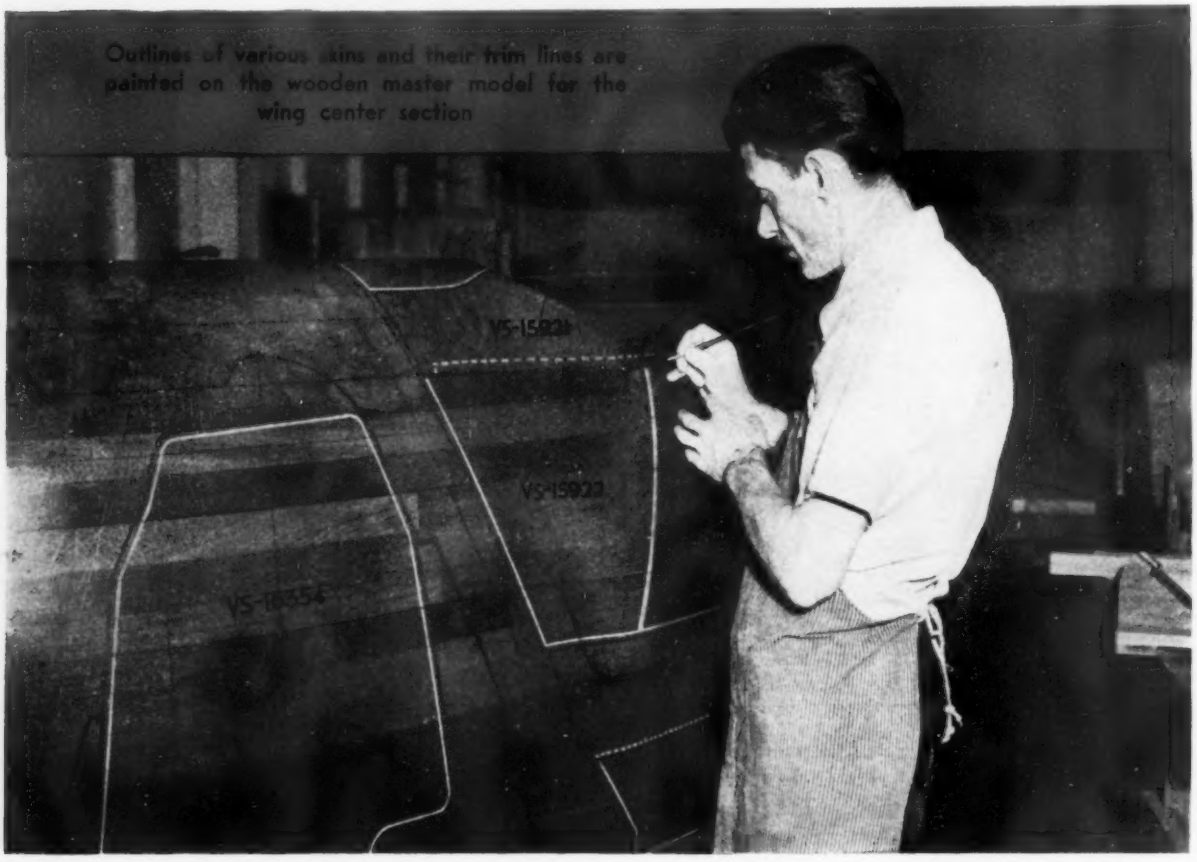
We determined to stretch the fuselage skins by a two-way process (HPM equipment) instead of rolling them, and to drill rivet holes in the formed skin rather than lofting the holes in the flat and taking a chance of mislocation after the skin is produced.

The production of thousands of interrelated mahogany models, accurate to a few thousandths, requires a definite procedure. From Vought-Sikorsky, we obtained 3,600 male templets made to the *outside* of the skin. But since stretcher dies were to be used for fabricating skins, it was necessary to produce a complete set of female templets made to the *inside* of the skin. These templets would be used to check the contours of the master mahogany models for skins and ribs fitting against the skins.

Templets were required for each station, or reference cross-section (commonly 4 in. apart) along the fuselage, or at the points where ribs or bulkheads are fastened. To obtain proper contours in these templets, it was necessary to establish a system for finding the coordinates of any point. A full-scale loft, or body layout, of the fuselage was prepared.

Fig. 1—The fuselage covering, or skin, was split into 33 panels, many of which are more complex than the one shown by cross-hatching. Drafting procedure of auto-body shops was utilized to establish the coordinates of any point in the ship, so that holes and contours of skins will fit corresponding details of internal ribs and bulkheads




Outlines of various skins and their trim lines are painted on the wooden master model for the wing center section
VS-15923
VS-15922
VS-15354

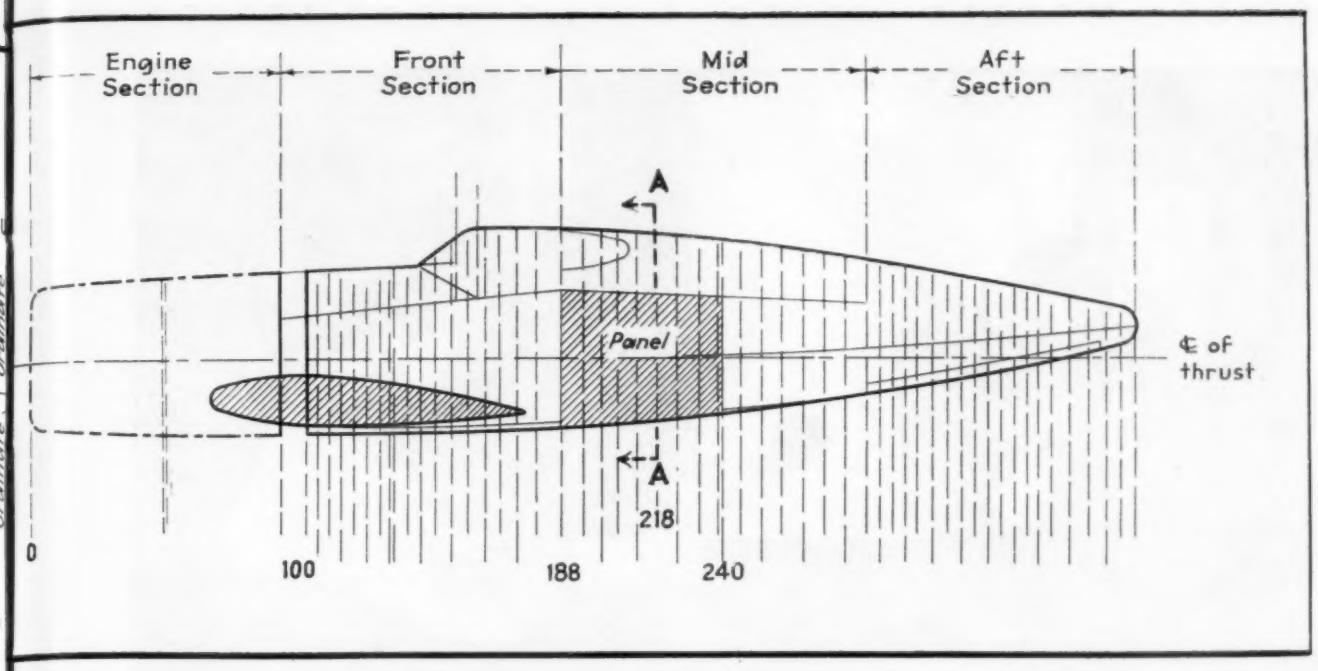


Fig. 1 shows how the master body layout is used by the pattern and templet shops. All skins were laid out on the side elevation view of the fuselage (only one panel is shown). Lines drawn normal to the centerline of thrust represent the stations. To make a mahogany model representing the inside surface of the panel shown, at least three templets are required. In other words, templets would be needed for stations 188, 218 and 240.

Coordinates for desired points on the templet contour are found by employing the principles used in auto-body layout. Section A-A shows how the coordinates of any point are established. In auto work, we speak of the "ten-inch line," meaning a point on the body ten inches above the frame line. In this case we may speak of the "28 U line" or the "8 L line," according to the location of a point on the fuselage above or below the centerline of thrust. The coordinates for points at specified distances above or below the centerline of thrust were established by measurement of the abscissa, and the results tabulated. Thus, on one master drawing, of which Fig. 1 is only a portion, we listed the master data for female templets at all stations. All female templets built to the inside of the skin were held to 0.003 in.

Before releasing templets to model production, they were set up at the proper stations on an 18×8-ft. surface plate, and the fairing was checked by design engineers, tool engineers and Navy inspectors against the full-scale loft drawing. Male templets for the ribs or formers were then made by spotting them to the skin templets to within 0.002 in. Pattern makers thereupon used these templets, together with a general sketch, to produce the mahogany models to within 0.004–0.005 in. at the corresponding stations.

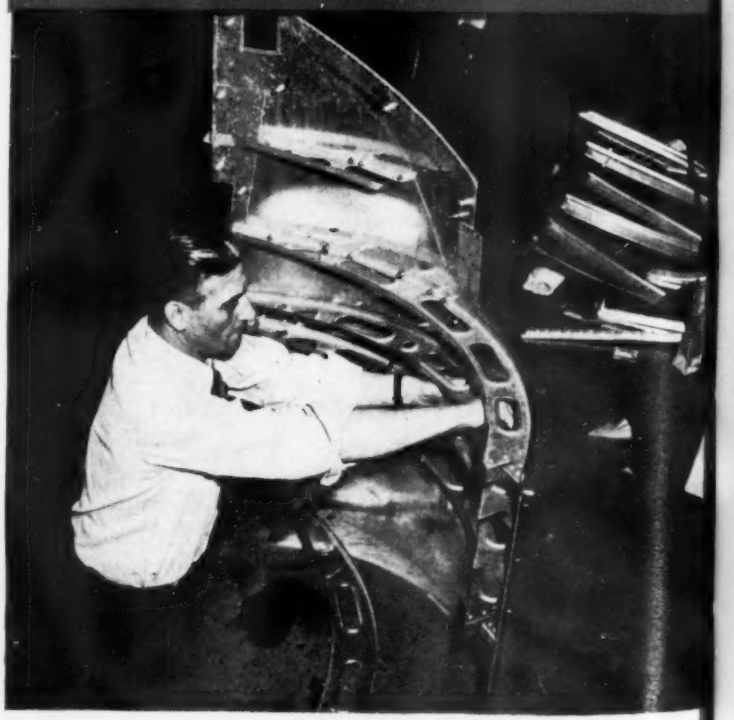
The models were next assembled upon the large surface plate and checked by all concerned for proper sweeps and contours. After passing inspection, the models became the "bible" for making and inspecting skins and bulkheads. All trim edges of these models are inlaid with $\frac{1}{8}$-in. steel plate to prevent chipping the edges or breaking the corners.

With approved master models in hand, the actual process of tooling up went forward swiftly, especially since a known standard was in existence. One of the first applications was connected with the production of steel dies for heavy forming operations (the leading edge for example) and the Kirksite punches employed upon HPM stretcher machines to produce skins. The models had been grooved at the vertical lines representing stations, and at horizontal lines representing significant ordinates, or "inch" lines. These grooves were filled with indelible paste, which transferred the lines to the face of plaster male impressions taken of the models. These plasters were used in several ways: (1) for making female plasters, or replicas of the wood models, when duplicates were necessary for Keller-machine set-ups on dies or fixtures, and (2) for spotting the dies and skin-drilling fixtures.

More than 25 percent of time required to build a skin-drilling fixture by conventional methods is saved through adoption of automotive practice. The fixture is of a cast skeletonized construction, mounted on a wooden bench having a steel lattice work frame which is adapted for drilling of coordinating holes and which also establishes actual trim lines. Kirksite surfaces of the major member bear against the skin at the respective fuselage stations to back up the sheet while drilling rivet holes. These Kirksite castings are made with a bearing surface of approximately 2-in. thickness. Re-

Mis-matching of holes is avoided by lofting the skin in the formed condition, not in the flat. A master skin templet is produced by fastening a stamping to the face of the master model and laying out holes according to the loft drawing. The skin becomes the templet for installation of drill bushings in the skin-drilling jig. Inspector at right shows how a matching rib is checked with a master model

Ribs are fastened to a drilled skin with Cleco clamps prior to riveting, are bound to assemble with minimum trouble because the holes coordinate



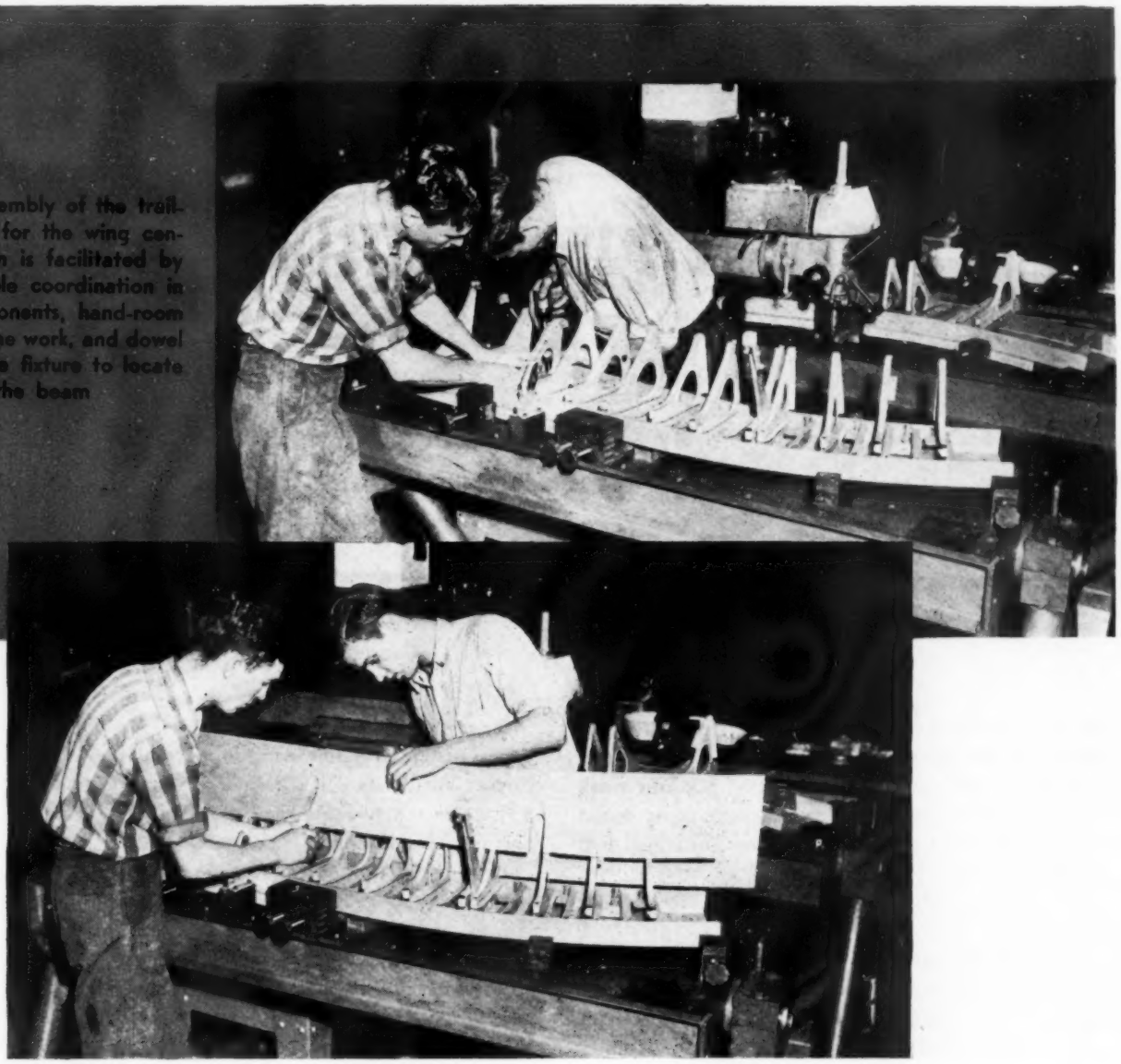
inforced in the casting itself are crossties which add to the strength and rigidity of the complete member. Skin surfaces are dressed to size and shape by the use of abrasive sanding disks, until a bearing is obtained using the plaster impression coated with prussian blue.

In this way, work-supporting surfaces in the fixture are made an exact replica of the master model. Steel edging around the periphery of the fixture provides a guide for the hand scriber used to mark the trim line on the skin. Excess metal is removed from the stamping with a routing machine. Stretched skins come to this fixture rough trimmed and with two tabs containing drilled holes for locating purposes.

We assemble ribs to fuselage skins upon benches, inserting Cleco quick-acting clamps in from three to six rivet holes provided per rib. The balance of the connection is made by spot welding. Obviously the two components must fit snugly and holes coordinate.

The holes in the ribs are not a problem. Outline of part and tooling holes are produced in the flat blank, and the flange is turned up in a second press operation. Rib flange holes are drilled in an inexpensive drill jig which consists of metal plates attached to a Masonite base. This insures a definite location of hole patterns from the ouside flange. Holes in the rib flange are coordinated with holes in mating skin. The master wood model for the rib and the loft drawing are easily employed to check hole location and fit of the part.

Hole location in the skin is another matter. The holes are not lofted in the flat sheet to avoid mislocation. If we produce a stamping on the two-way



Rapid assembly of the trailing edge for the wing center section is facilitated by proper hole coordination in the components, hand-room beneath the work, and dowel pins in the fixture to locate the beam

stretcher that exactly fits the master model and the holes are subsequently drilled to exact location, the completed skin must be correct. So before putting drill bushings in the skin-drilling fixture, three skins are produced from an approved stretcher-machine die. These skins are employed in the following manner:

1. The first skin is positioned on the master wood model set up on a surfact plate. A hole layout is made on the skin, using the master loft drawing, and the resultant piece becomes a master templet.

2. A second skin is laid out and drilled from the master produced as above and is then tried out upon the ship: That is, ribs are assembled to the skin and the whole is placed in a fuselage-section assembly fixture and assembled to bulkheads.

3. The master skin templet is thus proved by an independent check, and can now be employed to lay out the skin-drilling fixture. A third skin is drilled upon the fixture and built into a ship. If this skin passes inspection for fit, the part is released for a production run.

The master wood models are kept convenient to the production departments and are used for frequent inspection during a parts run, instead of built-up gaging fixtures. Thus, one definite standard is always available. If at any time, a design change is ordered, it is usually possible to salvage the wood model.

The decision to invest in thousands of wood models was not an easy one to make. Besides the expense involved, there were two questions that frankly interested management: (1) would the tooling system outlined actually prove practical?, and (2) could the job be done on time? The answer is simply this: We are in production ahead of schedule, and we believe that the assembly time to be saved through avoidance of "hammering and tinkering" will be an important factor in keeping pace with the Navy's accelerated procurement program.

Armor Plate Milling

★

By KARL B. KAISER

Chief Research Engineer, The Ingersoll Milling Machine Company

WHEN THE ARMAMENT program started, little was known of the possibilities of milling armor plate. During the last war much of the heavy machine work on this material was done with single-point tools; the few milling machines and cutters then used had become obsolete. It was necessary to start with a clean slate in studying the milling of modern armor plate.

The first consideration was fundamental; "What are the characteristics of the material to be cut?" Because of fast-moving metallurgical developments, there was no definite answer to this question. Rumors were plentiful, all agreed on one point—that the material was extremely difficult to cut. Feed rate was measured in inches per hour rather than the conventional inches per minute.

To find what could be done in milling armor plate, extensive tests were run. As a result, machines and cutters were designed which made possible the average performance records shown in Table I. The principles of milling cutter design and use that make these production rates possible apply specifically to heavy milling (such as thick rolled plates), but the fundamentals involved are adaptable to many lighter milling operations.

Certain characteristics of armor plate require deviations from standard milling practices for ordinary steels. Although the metal is not unusually hard, it is extremely tough and has a tendency to work harden. Hard spots are often encountered. In many cases, these are found to be harder than the cutter-blade material. These hard spots commonly arise from improper annealing of welds or torch-cut surfaces.

Successful milling of armor plate is dependent upon satisfying the following four requirements: (1) correct cutter design, (2) correct cutter grinding, (3) correct application of cutters, and (4) correct operating conditions.

Because of its toughness and tendency to work harden, armor plate is a material which must be cleanly cut. Therefore, it is imperative that relatively sharp angles be used in designing the cutter. Blunt angles result in badly torn surfaces, and if carried to extremes may result in burnished surfaces. A burnished surface has a pleasing appearance, but is undesirable because cracks or flaws are difficult of detection by surface examination.

In development of a face-milling cutter for armor plate, it was found that blunt angles generated excessive heat and caused the chips to "weld" to the cutting edges. Conversely, when sharp blade angles were used on cutters of the conventional design, the cutting edges were weakened and chipped easily, and chips clogged during heavy cuts.

To overcome these difficulties, a special design of the Shear Clear type of cutter was developed. The negative rake and the high positive shear angles of this cutter combine with the beveled cutting edge to produce effective rake and shear angles. This combination of angles results in free cutting qualities, in a shearing action that materially decreases the impact load on the cutting edge, and the chipping encountered when using sharp angles on conventional cutters. All chips are evenly coiled and thrown radially outward from the cutter, thus preventing clogging between the cutter body and the work.

The chip formation on a typical armor plate cut 1 in. deep and 11 in. wide is shown in Fig. 1. This ready clearing of the chips also permits the space between the cutter body and the finished surface to be used for backing up each blade directly behind the cutting edge. The chips obtained with a correctly designed and with an incorrectly designed cutter on the same job are shown in Fig. 2.

The above combination of angles also effects a definite reduction in the power required to remove metal. This means that on machines where power is a limiting factor, the production rates can be increased. Conversely, if the feed rate is held constant, the Shear Clear cutter will put less stress on the machine and workpiece.

Because of its beveled cutting edge, the Shear Clear cutter is not suitable for cutting into a square corner, but can be used for roughing out the stock if followed with a conventional face mill for the finishing cut. To design a conventional cutter for milling in square corners, use a minimum rake angle of 10 deg. and a shear angle from 15 to 20 deg. Chip clearance should be provided by milling channels in the cutter body instead of projecting the blades from it, to provide better support for the blades when taking roughing cuts on tough armor plate.

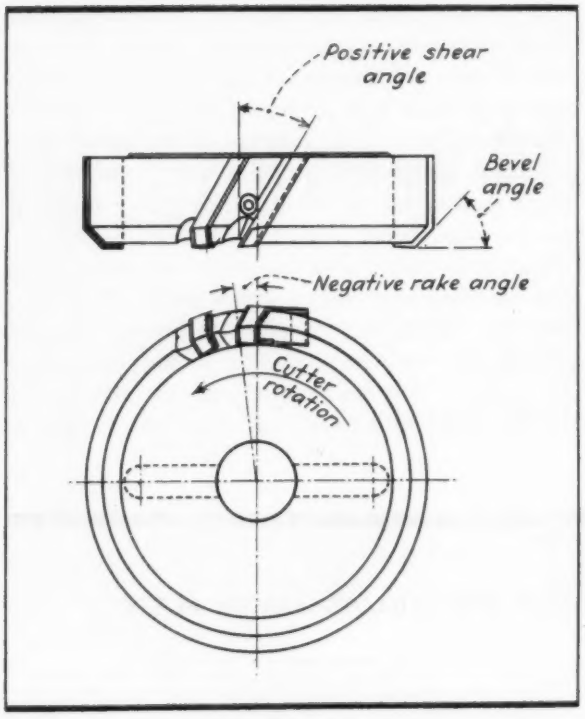
Slab mills, rather than face mills, are required for a number of operations on armor plate. A 10-deg. rake and 30-deg. shear angle have proved the most satisfactory combination. Because of forces set up in slab milling, it is desirable to keep the diameter of the tool large with respect to its length in order to

Table I—AVERAGE PERFORMANCE RECORDS FOR MILLING ARMOR PLATE

	Performance — 1940	*Performance — 1943*
Feed Rates	Average ¼ in. per min. Maximum ⅜ in. per min.	Average 1½ to 2 in. per min. Maximum 3 in. per min.
Depth of Cut	⅞ in. maximum	3½ in. maximum
Metal Removal Rate	4 cu. in. per min.	30 cu. in. per min.
Power Consumption	0.25 cu. in. metal removal per hp. per min. average	1 cu. in. metal removal per hp. per min. average
Cutter Life	4 to 6 hr. average	6 hr. average 36 hr. maximum
Production Time (Typical Job)	60 to 72 hr. floor to floor	6 hr. floor to floor

Table II—FEED RATES FOR MILLING ARMOR PLATE

	Size of Cut in Inches		*Feed Rate*	
TYPE OF CUTTER	Depth	Width	In. per Tooth	In. per Min.
Shear Clear Face Mill	½ to 1¼	6 to 12	0.015 to 0.030	1½ to 3
Shear Clear Face Mill	1	12 to 18	0.018	1½
Shear Clear Face Mill	½	12 to 18	0.024	2
Shear Clear Face Mill	¼	12 to 18	0.030	2½
Standard Face Mill (Square Corners)	¼ to ½	6 to 12	0.010 to 0.020	1 to 2
Standard Face Mill (Square Corners)	1	6 to 12	0.010 to 0.015	1 to 1½
Helical Slab Mill (6 in. dia or over)	¼ to ½	6 to 10	0.010 to 0.020	1 to 2
Helical Slab Mill (6 in. dia. or over)	1	6 to 10	0.010	1
Solid H.S.S. End Mill (Under 3 in. dia.)	½	2 to 3	0.006 to 0.010	¾ to 1



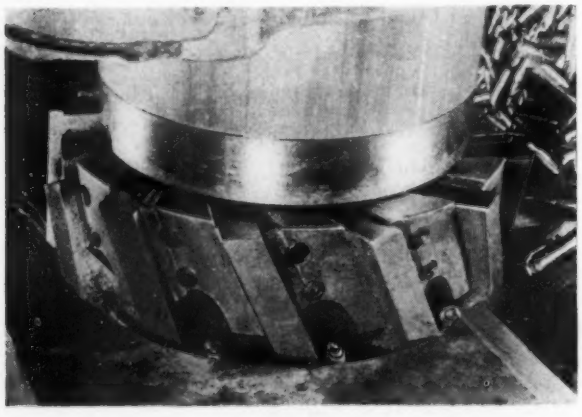


Fig. 1—Chips are coiled uniformly and thrown radially out of the Shear Clear cutter by the combination of negative rake, a high positive shear angle and a beveled cutting edge. How these produce effective rake and shear angles is shown above

minimize deflection. This reasoning applies also to helical end mills for which it is usually impossible to provide an outboard support.

Inserted-blade cutters of 3 in. diameter and larger are the most economical type to use because of the hard spots encountered in armor plate. Serrated blades, with a locking device that contacts them over the full length of the slot, prevent movement while cutting.

The cutter-design principles cited apply to high-speed steel cutters. High-speed steel has been found most practical where heavy depths of cut are involved in armor-plate milling.

The types of grind that give the best general-purpose results for three typical cutter designs are illustrated in Figs. 3, 4 and 5. Relief and clearance angles should be kept to a minimum. A primary relief, or back-off, of 0.004 in. per $\frac{1}{8}$ is recommended. Higher relief angles have a tendency to cause chatter and a reduction in cutter life.

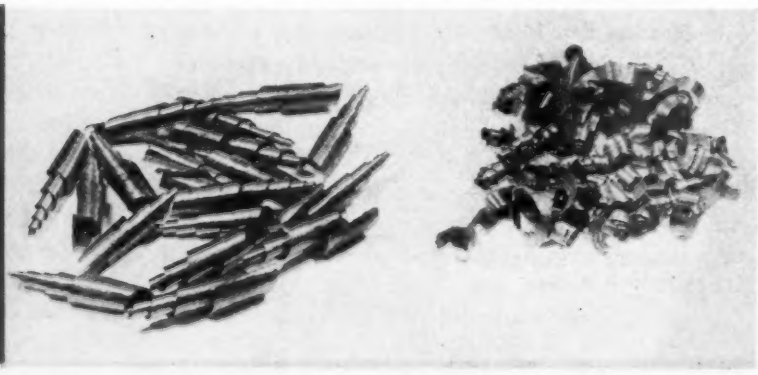
Valuable production hours are saved by planning the job so that correctly designed cutters are used in the proper sequence. Fig. 6 illustrates the advantages of specially designed angular cutters and end mills on a typical difficult machining job upon armor-plate components. Since the piece is a segment of a circle, all cuts follow the radius of a circle.

Four cuts are taken in area *A* at the first operation, to rough out the maximum stock in the shortest time. The cutter designed for this purpose is capable of higher feed rates than attainable with other types.

A conventional face mill is used for the second operation, to cut the square corners in area *B*. Chips are cleared satisfactorily with no loss in feed rate because of the relatively small amount of stock to be removed. A cutter change is saved by using the same tool to rough area *C* instead of an end mill.

Maximum rigidity and feed are obtained in the third set-up by using an angular end mill of relatively large diameter to make the cut *D*. The cuts taken are all in clean metal, hence the same cutter is employed for the roughing and finishing operations.

Fig. 2—Chips tell the story. At left, those produced by the Shear Clear cutter design principles; at right, the product of a conventional cutter when used on the same job.



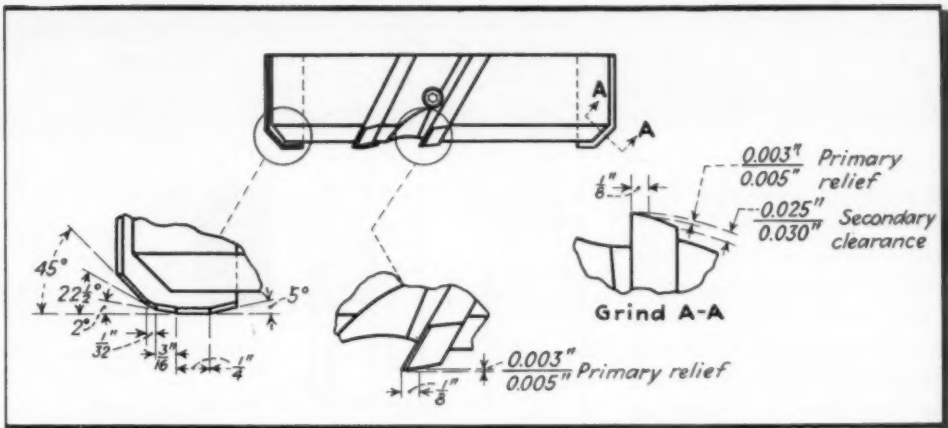


Fig. 3—Correct cutter grinds constitute one of the four fundamentals in milling armor plate. The angles shown are satisfactory for a Shear Clear face mill

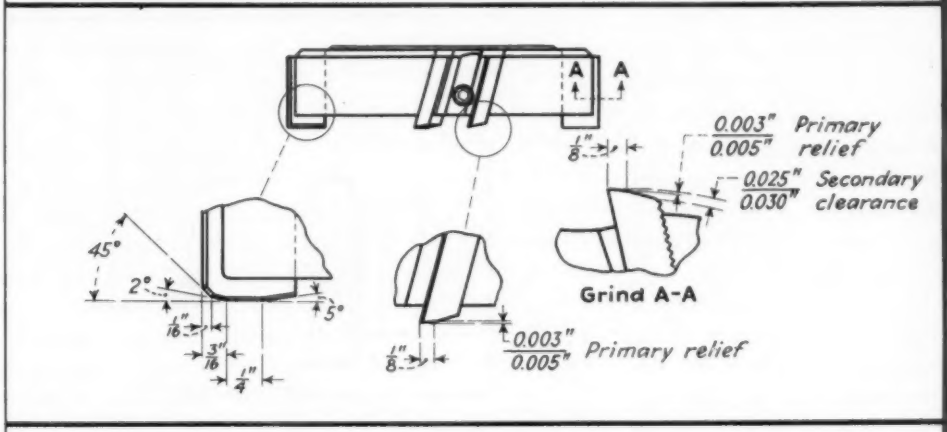


Fig. 4—In case a conventional face mill must be used, these angles have proved feasible

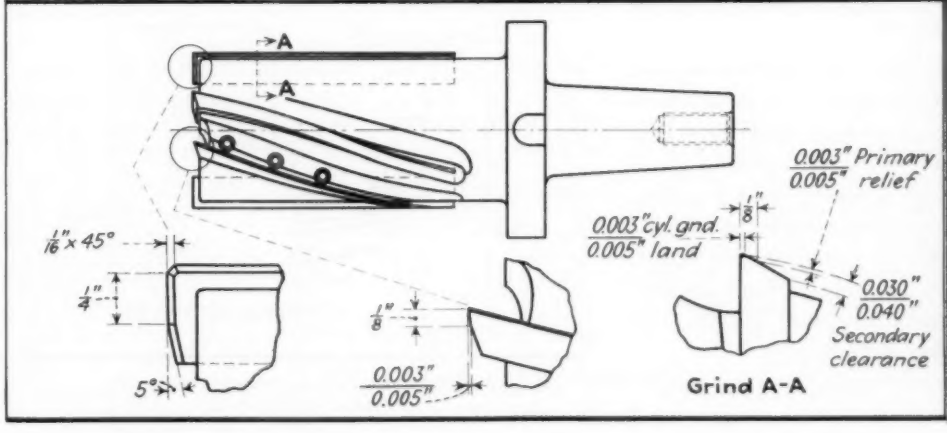


Fig. 5—End mills of Shear Clear design should be ground as shown for milling armor plate. Higher clearance angles have a tendency to cause chatter and reduce cutter life

The cut taken in the fourth set-up requires a solid end mill, because it is impossible to use as many blades and as favorable angles in an inserted-blade cutter of this size. Half of the stock in area *E* is removed on the first pass, and the remainder in a second pass, because of the length of cutter and depth of cut involved.

Though the diameter of the end mill is small for the operations performed in the fifth set-up, an inserted-blade cutter is specified for finishing the angular surfaces *H* and *K*. The lightness of the cut permits good cutting action with this tool. Moreover, if the angularity of the surfaces should be altered, the inserted blades can be changed readily to the new angle.

Last of the four fundamental requirements in milling armor plate—correct operating conditions—is the most important. Misunderstanding or neglect in operating the cutter under correct conditions of speed, feed and other factors may easily destroy the advantage of close adherence to the first three fundamentals. Particular attention should be given to the following matters.

The most satisfactory cutting speed for heavy milling cuts on armor plate is 15 to 20 ft. per min. One of the most common causes of short cutter life and low feed rate is the use of too high a spindle speed. It is often forgotten that it is the *feed* rate, not the peripheral speed of the cutter, that pays production dividends. Simple conversion charts placed near the

operator will assist him to maintain the correct cutting speed for various cutter diameters.

Peak efficiency in milling armor plate is obtained when the feed rate is such that the chips are a light straw color when using a full flow of coolant. Of course, the attainable feed will vary with the size of the cut and the condition of the material. It is impossible to establish a feed rate that will definitely apply in all cases, but the figures given in Table II represent feeds that can be maintained on the average job with the correctly designed cutter and a modern machine.

Delivery of a large volume of coolant at the point of cutting is one of the most vital factors in milling armor plate, but often neglected because of the messiness involved. From the cutting standpoint, sulfurized oil is preferred but soluble oil is usually applied when large pieces and large machines are involved, to reduce cost and chance of injury to the operator from slipping on oily machine or floor surfaces.

In roughing heavy work, the best depth of cut ranges between $\frac{3}{4}$ and $1\frac{1}{2}$ in. Cuts as deep as $3\frac{1}{2}$ in. have been taken in testing, but such depths are not ordinarily practical in production since an extremely rigid set-up is needed to withstand the pressures involved.

Cutter life between grinds is unpredictable because of the likelihood of encountering hard spots in armor plate. This circumstance makes it imperative that the operator maintain constant watch of the type of chip obtained. When chips suddenly become hotter, serious damage to the cutter can usually be avoided by quickly decreasing the feed and spindle speed. Running a dull or chipped cutter on armor plate may prove very costly in respect to cutter damage, and repair work on a work-hardened piece.

The toughness and work-hardening properties or armor plate require special attention to providing extreme rigidity in the machine and set-up. A small amount of deflection in the fixture or workpiece will cause the cutter to "ride" over the surface and build up pressure instead of cutting cleanly. The principal point to be remembered when planning set-ups and designing fixtures is the direction of the cutting forces.

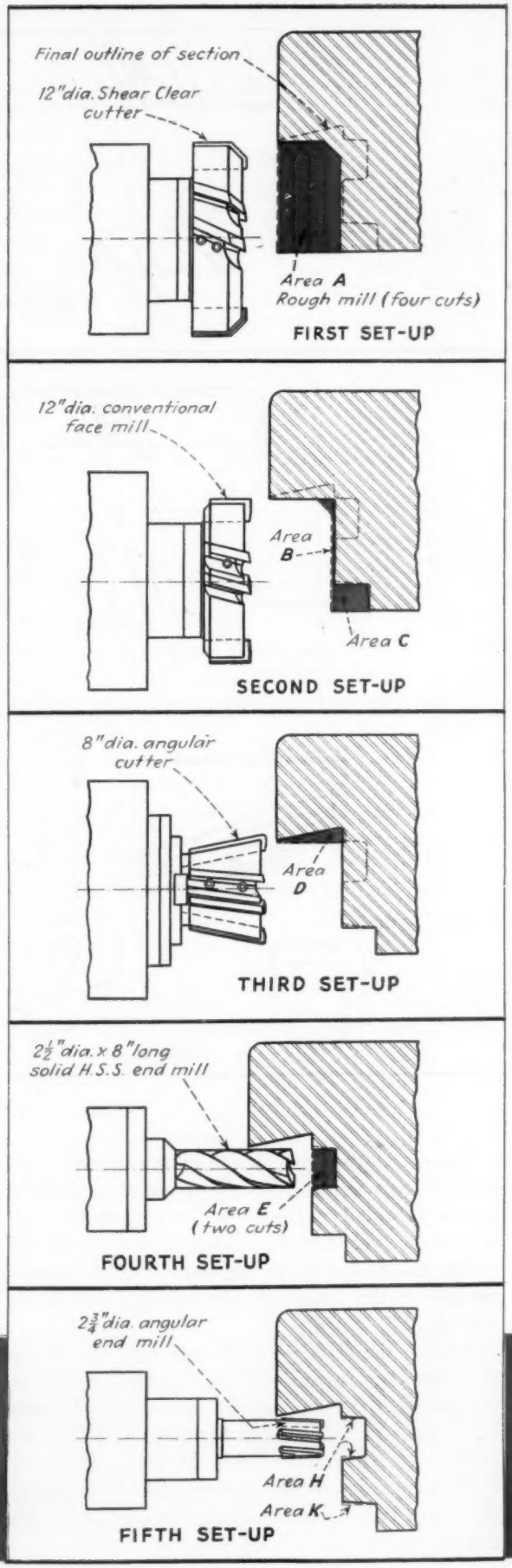


Fig. 6—Cost of specially designed cutters is justified on this typical machining job. Since the work is a segment, all cuts are profiles

Tolerances for Worms and Worm Gears—I

A standard practice adopted by the American Gear Manufacturers Association, and known as "Inspection and Tolerances for Gears—Part II"

FOREWORD

THIS STANDARD PRACTICE, subject to periodic revision, is intended to form a practical basis upon which gears can be manufactured, inspected, sold, or purchased, although it is not necessarily a rigid specification. It is emphasized that ultimate performance is the final criterion in the acceptance or rejection of gears, regardless of whether they meet arbitrary tolerances. In other words, if gears run smoothly and carry their rated load without breakage or appreciable wear, they will be acceptable for many applications. But when gears fail to perform satisfactorily, definite inspection methods and tolerances are invaluable in locating the cause.

An important consideration is that of the relation of cost to accuracy. Production of gears to the closer tolerances always costs more. In some instances stipulation of the closest tolerances when they are not needed may result in a cost several times what it should be.

IN CONTRAST to spur and helical gearing, satisfactory operation of mating worms and gears cannot be so readily predicted from individual inspection. Profile errors of worms are easily determined by direct measurement, assuming the method of cutting or grinding the teeth results in a tooth form approximating a straight line, an arc of a circle or an involute, either in an axial or normal plane. On the other hand, the profile errors of worm gear teeth cannot be directly measured because of the change in pressure angle across the face of the gear. Therefore, tolerances for profile errors of worm gear teeth are necessarily omitted, and instead reliance is placed on observation of contact with a master worm or the mating worm. This limitation, inherent in worm gearing, places more responsibility upon the personal judgment of the inspector.

SCOPE

These tolerances are restricted to the conventional type of worms and gears comprising cylindrical worms and throated worm gears meshing at right angles.

DIAMETER RANGE

The worm diameters considered are from $\frac{3}{4}$ to 12 in. in a geometric progression; namely, $\frac{3}{4}$, $1\frac{1}{2}$, 3, 6, and 12. The worm-gear diameters considered are from $\frac{3}{4}$ to 100 in. arranged in a similar manner. Tolerances for other diameters may be interpolated.

PITCH RANGE

The pitches considered are from $\frac{1}{8}$ to 4 axial pitch arranged in a geometric progression; namely, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1, 2, and 4. Tolerances for other pitches may be interpolated.

CLASSES AND SPEEDS

Four classes of worms and gears are listed according to use. These are:

	Worm speed ft. per min.
Precision high-speed	over 1,000
Commercial high-speed	up to 1,000
Commercial medium-speed	up to 200
Low-speed	up to 40

These classes of worms and gears and their definitions in terms of speeds are arbitrary. The name "precision high-speed," is assigned merely for convenience. There are cases when tolerances for precision high-speed worms and gears are applicable for lower speeds, for example: timing mechanisms, dividing worm gears, gun-sighting worm gears and high tooth loading. Likewise, tolerances for the low- and medium-speed worm gears may be satisfactory for higher speeds in some instances. The speed ranges of 40, 200, and 1,000 are arranged in a geometric progression. Unlike spur and helical gearing, the tooth loading varies substantially with the speed—the higher the speed, the more the tooth loads must be restricted to avoid excessive surface temperature of the teeth.

TYPES OF ERRORS

The fundamental errors for which tolerances are given are:

WORMS

1. Runout
2. Pitch error
3. Profile error
4. Lead error, total variation per convolution
5. Lead error, total variation per length of worm

WORM GEARS

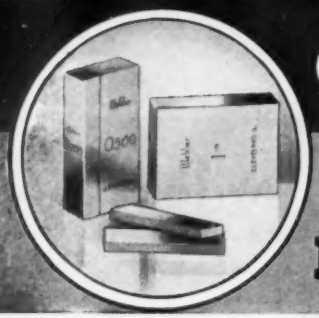
1. Runout
2. Pitch error
6. Accumulated error
7. Required initial area of contact

Tolerances for backlash are not included because of the separate Standard Practice of the A.G.M.A. for "Backlash in Gears," to be published in an early number. Tooth-thickness and pitch-diameter measurements are related to backlash and are therefore omitted.

Tolerances for combined error tests of various sorts are omitted for simplicity, although their value for routine checks is recognized.

Tolerances for various dimensions of worm and worm gear blanks, such as hole size, outside diameter and face width, are not yet established, but may be ultimately included because of their importance to gear accuracy.

Tolerances for tooth-surface finish and for quietness are considered beyond the scope of this standard practice. Yet surface finish in worm gearing is more important than with spur and helical gears. It is essential that the harder of the two members—usually the worm—have a high degree of surface finish.



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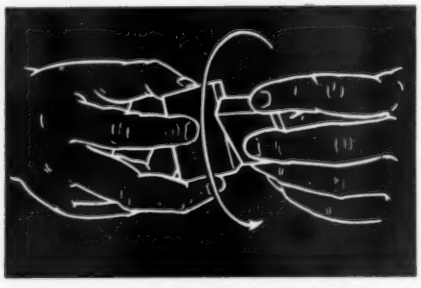
No. 3–Correct method of wringing gages together

When wringing gages together to build up to a desired size wipe the gages across the palm of the hand or the inside of the wrist and then carefully slide the gages together. They should then take hold and adhere to each other very strongly.

It is not good practice to leave the gages wrung together for a considerable period of time as there is a possibility of the slight film of moisture trapped between the surfaces causing the two contacting surfaces to rust or corrode.

When building up a combination of blocks requiring two or more blocks the heat absorbed from the hands must be dissipated before this combination will come back to room temperature or to the temperature of the work to be measured. It is common practice to place the combination of blocks on a surface plate and allow them to stand until this heat has been dissipated.

The combination for all practical purposes is as solid as a single block and may be handled as a unit. The blocks are easily separated by the simple sliding movement by which they were "wrung" together.



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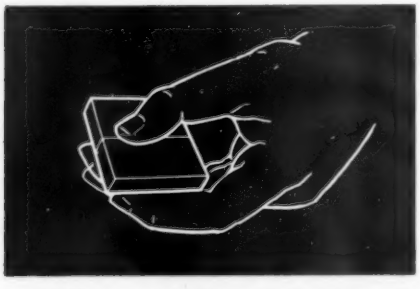

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Tolerances for Worms and Worm Gears—II

To clarify the meaning of the five types of errors considered, each is defined and explained in the sections that follow immediately.

1. *Runout*

Runout of a worm or worm gear is the total difference between high and low readings of a dial indicator suitably arranged to denote the off-center relation of the axis of the tooth profiles with respect to the journals or the axis about which the worm or worm gear rotates. It is twice the eccentricity. It includes the effect of side runout or wobble.

A gear cutting or grinding machine in proper operating condition should produce teeth without appreciable eccentricity in relation to the axis of rotation of the machine. When eccentricity occurs, it is almost always due to inaccuracies introduced when the worm or gear is removed from the cutting or grinding machine and mounted somewhere else for inspection or operation. Runout and eccentricity can be held to close limits only by having true and accurate fits in journals and bores of blanks, shafts, arbors and chucks.

Runout may be measured by an indicator applied to the bottom lands of tooth spaces, provided the bottom lands have been milled, hobbed, or ground simultaneously with the profiles.

Runout of teeth roughed deeper than the finish cut may be checked by a pin, plunger or V-block placed in the tooth spaces to actuate the indicator. Such readings may be affected by pitch errors and should be interpreted accordingly.

On small worms it is practical to measure runout by the projection method, in which a magnified shadow of the worm is compared with a templet as the worm is rotated to successive positions.

Runout of worms may be measured by an indicator applied to proof diameters at each end of the threads if the proof diameters are trued up in the same setting used for finishing the threads.

It may be measured by an indicator applied at the outside diameter of the worm gear teeth if a topping hob has been used.

It may also be measured by observing or graphically recording the center distance variation when rotated tightly in mesh with a master worm or worm gear, excluding the effect on such center distance variation caused by profile errors, errors in spacing and interference.

On worms, the runout may vary appreciably across the face width, and consequently should be measured near both ends. Appreciable difference in runout near the two ends is an indication of wobble, which is more objectionable than uniform runout.

Wobble is likewise objectionable on worm gears, and may best be detected in the test for area of contact.

(To be continued in an early number)

WORM INSPECTION TOLERANCES*

CLASS	Axial Pitch, In.	Runout of P. D. Total Indicator Reading					Pitch Error in Axial Plane Multiple Threads Only					Profile Error Total Variation Not Plus and Minus Lead Angle			Lead Error Total Variation Per Convolution Lead Angle		Lead Error Total Variation Per Length of Worm Lead Angle		
P. D.		¾	1½	3	6	12	¾	1½	3	6	12	0–15°	15–30°	30–45°	0–15°	15–30°	0–15°	15–30°	30–45°
Precision High-Speed Over 1,000 Ft. per Min. Worm Speed	1	..	..	8	8	10	..	..	5	5	8	4	6	8	5	10	10	12	14
	½	..	5	8	8	10	..	5	5	5	8	3	5	7	5	9	8	10	12
	¼	5	5	8	..	..	5	5	5	..	..	3	4	5	4	7	6	8	10
	⅛	5	5	..	..	..	5	5	..	..	..	2	3	4	3	5	5	6	7
Commercial High-Speed Up to 1,000 Ft. per Min. Worm Speed	2	..	..	..	15	..	..	..	..	12	..	8	10	12	15	20	18	20	24
	1	..	..	12	12	15	..	..	8	8	12	6	8	10	7	12	14	16	18
	½	..	8	12	12	15	..	8	8	8	12	5	7	9	7	11	12	14	16
	¼	8	8	12	..	..	8	8	8	..	..	5	6	7	6	9	10	12	14
	⅛	8	8	..	..	..	8	8	..	..	..	4	5	6	5	7	9	10	11
Commercial Medium-Speed Up to 200 Ft. per Min. Worm Speed	2	..	..	..	20	20	..	..	..	15	15	10	12	14	17	22	23	25	30
	1	..	..	15	15	20	..	..	12	12	15	8	10	12	9	15	19	21	23
	½	..	12	15	15	20	..	12	12	12	15	7	9	11	9	14	17	19	21
	¼	10	12	15	..	..	12	12	12	..	..	7	8	9	8	12	15	17	19
	⅛	10	12	..	..	..	12	12	..	..	..	6	7	8	7	10	14	15	16
Low-Speed Up to 40 Ft. per Min. Worm Speed	4	..	..	..	..	80	..	..	..	..	25	30	40	45	40	80	80	100	120
	2	..	..	..	50	60	..	..	..	18	20	13	15	17	25	35	35	40	45
	1	..	..	40	50	60	..	..	18	18	20	11	13	15	15	22	28	32	35
	½	..	30	40	50	60	..	15	18	18	20	10	12	14	15	20	25	28	32
	¼	30	30	40	..	..	15	15	15	..	..	10	11	12	12	18	22	25	28
	⅛	30	30	..	..	..	15	15	..	..	..	9	10	11	11	15	20	22	24

* All readings in ten-thousandths of an inch.

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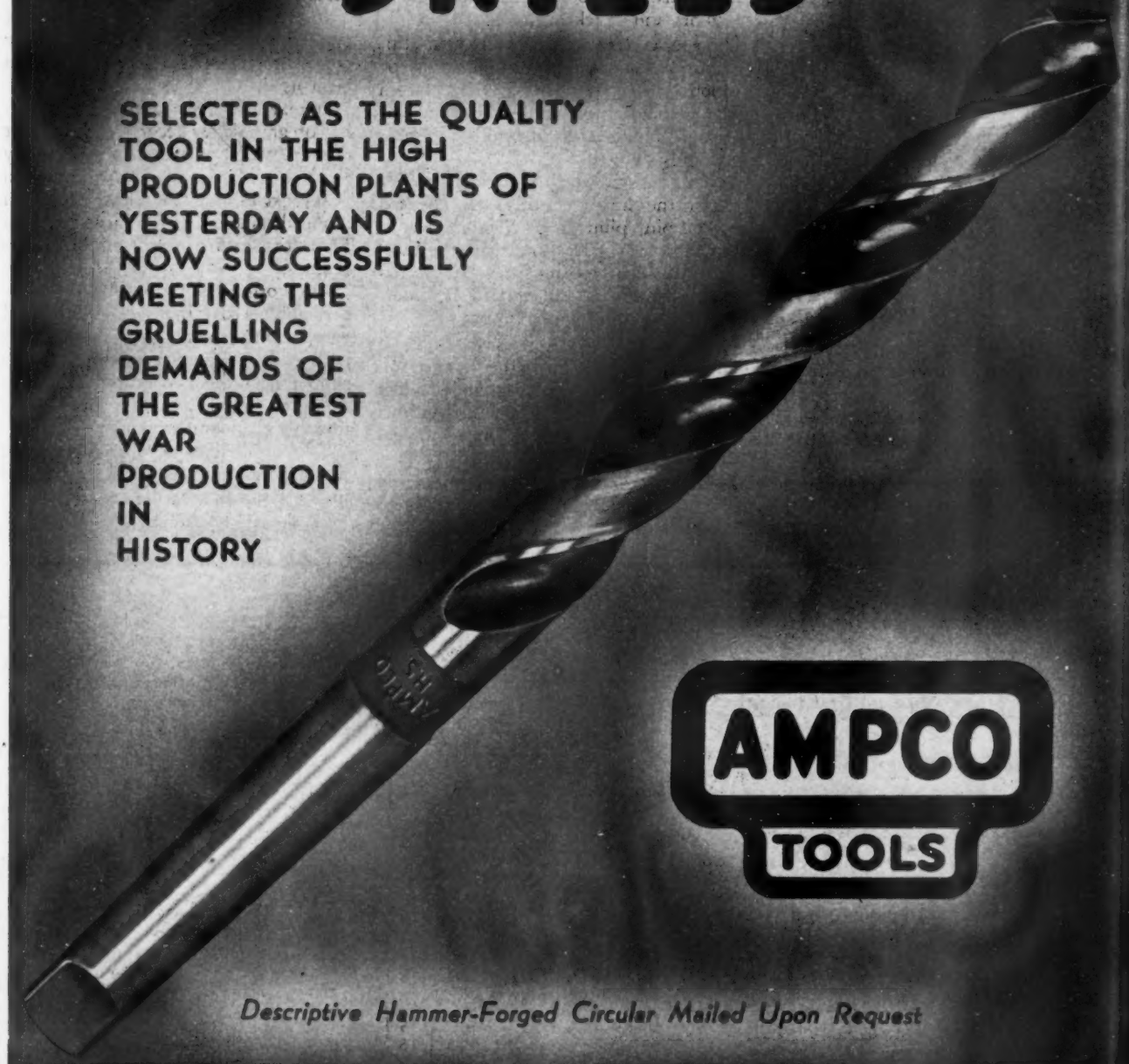

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AN INSIDIOUS IDEA is spreading that threatens a breakdown in our war production program.

This idea is that the war is already won and that from here on all we have to do is to coast.

It is easy to understand how the idea took root. Output of war goods has expanded miraculously. Production of some military items, particularly tanks, has become so big that cutbacks of large proportions have had to be made in the schedules.

The British and Americans won a spectacular victory in North Africa. Attu was conquered, Pantelleria was bombed into submission, and Germany and Italy are being hammered ceaselessly from the air.

This succession of events is breeding over-confidence and is leading people to believe that victory is "in the bag."

If this tendency is not checked immediately, it may lead to disastrous consequences, for a slackening of effort now is likely to prolong the war needlessly.

The cold facts contradict those who believe that the war production goal has been reached. Despite our amazing output thus far, we are far short of our objectives.

In the first six months of 1943 we will have turned out about 41 percent of the year's scheduled production. That means that in the next six months we must step up manufacture to a rate half again as big as in the first six months. That is a challenge that must be met.

Even after output rises to a new peak late this year, we dare not let down if we are to maintain our timetable for victory. In 1944 our requirements will be more than in 1943.

Dislocations of production are unavoidable and inevitable in any war. That is because the enemy by his actions decides for you what you are to make and what you must quit making.

But such dislocations must not be mistaken. We may have too much of some things, but it is common knowledge that we have too little of many vital items—escort vessels, merchant ships, combat ships, bombers, fighting planes. And we still are short of raw materials and of machine tools.

No man, including Mr. Churchill and Mr. Roosevelt, knows how long the war will last. The "ifs" in favor of an early conclusion of the war with Germany are more than offset by solid facts pointing to a long and hard conflict.

All military and naval men who know the Japanese intimately predict that they will fight savagely to the last man. Nothing has happened thus far to indicate the contrary.

Hence the tendency to let down and regard the war job as done is not only distressing, but is causing genuine and justifiable alarm in the high command at Washington.

There is no sign in the present situation, encouraging as recent developments have been, to support the idea that this is the beginning of the end. More logically a summation of the facts leads to the conclusion that we are well in the phase of the war that Mr. Churchill calls "the end of the beginning."

To end the war as quickly as possible, the best thing that everyone in industry can do is to continue to produce more and more goods with unabated zeal.

Our main and continuing responsibility is to see that our fighting forces and those of our allies get enough and on time.

Burnham Finney

GAGING BUSINESS

War good production timetable is to rise to year-end peak, to balance low first half output. No liklihood of early allotments for non-essential civilian goods. Tool production declines gradually. Plane, ship production rises

Second Half Must Be Better Approximately 41 percent of the country's war production schedule for the entire year 1943 was attained during the first six months, according to accurate estimates emanating from Washington. That means that if the year's goal in planes, guns, ships and other war products is to be reached, output in the second half of the year must be some 50 percent greater than in the first half.

Actually the timetable for manufacture of war goods is being met. The plan all along has been to step up operations month by month until a peak is reached late in the year. The peak probably won't come until December, compared with earlier predictions of October. Production then is likely to level off and stay close to December volume indefinitely. More war goods will be needed during 1944 than in 1943.

Producers Can't Coast Yet This outlook for expanding operations should put to rest the spreading idea that the war production job is so far along that the country can afford to slacken its efforts. The truth is that Washington is much disturbed by the tendency to regard the war as already won and hence to lessen the pressure. Cutbacks in production schedules have been of serious proportions, especially in tanks, but demand for other products has far more than offset these losses. Some of the cutbacks, in fact, have been eased by orders for other items. Two tank builders, for example, have received large orders for manufacture of locomotives and railroad cars. Another tank factory is expected to make aluminum parts for airplanes. Electrical workers formerly employed on war plant construction are being transferred to the wiring of ships. In this reconversion process, however, the relationships between prime and subcontractors are being badly affected, the latter having to look around for other connections.

Up until this year the country spent on construction and equipment of its war plants 90 percent of the amount paid out for actual munitions produced. Now that the nation's war manufacturing facilities are fairly well built, the ratio of construction and equipment to munitions output will drop sharply.

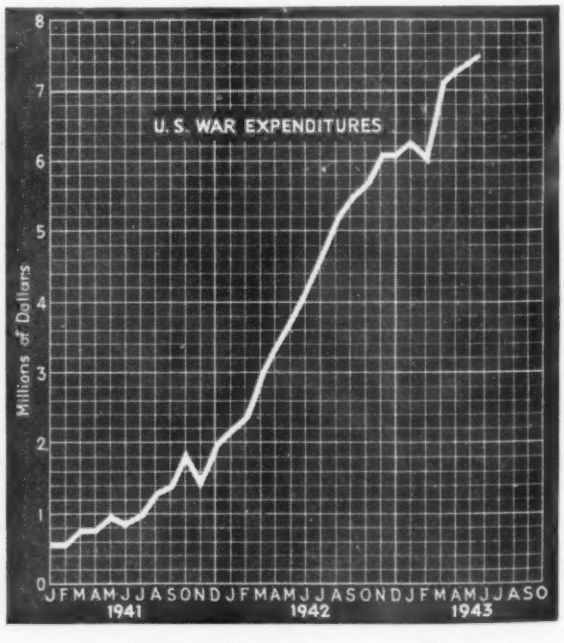
Ship And Plane Production Rises Plane production this year will be twice that of 1942 in numbers, but will be three times as great measured by weight, as larger and larger planes and more big bombers are built. Merchant shipbuilding will probably reach its peak in August and then stay on the August level for many months. Manpower and not steel supply is now the main limiting factor in production of merchant ships. No new yards are contemplated. It is believed that projected schedules can be met with existing facilities. Efficiency of labor in shipyards is reported to have improved recently. The number of women employed in shipbuilding has grown rapidly until today 15,000 to 20,000 women, or about 20 percent of the total working force, are on duty in northwestern Pacific coast yards. Inland yards are making a substantial contribution to shipbuilding in numbers of unit, although the tonnage obviously is not so big.

Though more material is being allotted for production of essential civilian goods, especially for maintenance and repair, there is no prospect whatever of relaxation in the near future of restrictions on the manufacture of so-called luxury or non-essential products. All claimant war agencies are asking for a total of 23,000,000 tons of steel in the third quarter, with only 17,000,000 tons available. Just how much of the demand from the agencies is excessive is not clear, but in any event a severe shortage looms. The War Production Board is making a drive to squeeze another 1,000,000 tons of steel out of the mills in the third quarter.

Tool Orders Taper Off Machine tool production is gradually declining, but still is up close to $100,000,000 a month. Incoming orders, after cancellations, are about $50,000,000 a month. Some war contractors, particularly on aircraft work, have received only 20 percent of the machine tools needed for new programs. WPB is turning on the heat to speed deliveries in such cases. Pool orders will be continued, but the delivery time covered probably will be shortened and a tightening of requirements will be enforced. Both Russia and England continue to demand sizable quantities of machine tools.

WPB officials admit that an erroneous impression was circulated that the machine tool industry's job in the war effort was completed. That is not the case. So long as the war lasts a considerable supply of new machine tools will be required, as the shifting in the war makes necessary new or altered production programs. However, output of machine tools will continue to decline the remainder of this year and the slack capacity will be taken up largely by direct war work, much of it on a subcontract basis. Machine tool builders now are making turbines, valves, torpedoes, aircraft engine parts and Diesel engine parts, to mention only a few. There has been a growing demand for special, single-purpose machine tools, especially for aircraft work. Builders of such equipment will be busy for many months.

Nearly Double—War expenditures for May, '43, were $7,373,000,000; one percent over the $7,290,000,000 of the month preceding and 93 percent over May, '42. War expenditures since July 1, '40 were $102,000,000,000. Says Donald Nelson in his report to the President, "Today we are turning out nearly as much war material, measured in dollars, as we ever produced for peacetime needs, and we have enough industrial power over to keep civilian living standards higher than we hoped for."



Renegotiation Hearings Not Expected to Alter Law

Complaints of manufacturers to their congressmen have resulted in a review of policy; many informed sources deplore the move, believe little or no good will result

BY ROBERT COLBORN

WASHINGTON—Two weeks hearings by House Naval Affairs Committee on renegotiation of war contracts are drawing to a close. Question before the Committee is whether to let the law stand as it is, change it, or repeal it. This reexamination of policy is conducted at the instigation of many manufacturers who have been pounding their congressmen with complaints.

Testimony for and against price adjustment under this law is almost entirely a recapitulation of previous hearings and later protest and discussion. Manufacturers want to be allowed to accumulate reserves for postwar operations; the law is discriminatory because it covers the contracts of only the War and Navy and Treasury Departments and the Maritime Commission; adjustments are made before taxes; it permits the procuring agencies to use the recaptured funds otherwise than as provided by congress; it does not provide against unforeseen losses and emergencies; it discourages manufacturers from seeking new government contracts; the bookkeeping is onerous, expensive, and it mitigates against efficiency in production; recapture of profits is unnecessary because of the excess profits tax laws. Those are the arguments of witnesses opposing the law as it stands.

Expect No Repeal

Informed opinion here is that the hearings certainly will not result in repeal of the law, and probably not in substantial modifications. Most of the important renegotiating has been done. This was based on contracts made before production lines had settled to routine—before costs could be determined. Target cost accounting is now quite accurate and is widely practised. It is late in the war for a drastic change in the law, even though the above arguments indicate a less-urgent need for it now than ever.

The Vinson Naval Affairs Committee is the one that instigated the ship and plane profit limitation laws three years ago, and there is no reason to believe that Vinson or the members have changed their minds on profit control. The price control law, however, is being used as an incentive and demerit system, and they might have different ideas on that.

Selective Service Prefers To Draft Other Than Fathers

WASHINGTON—Date when employers should expect to lose their draft-age employees who are fathers keeps retreating farther into the future. Originally scheduled for July, it now looks more like August or September, and the latest date to be mentioned is October. This last should not be taken too seriously by fathers who are not in essential industries utilizing replacement schedules. Such essential industries have been instructed to start scheduling their fathers for induction on Oct. 1. For others it's likely to start earlier, though Selective Service is doing all it can to postpone the evil moment.

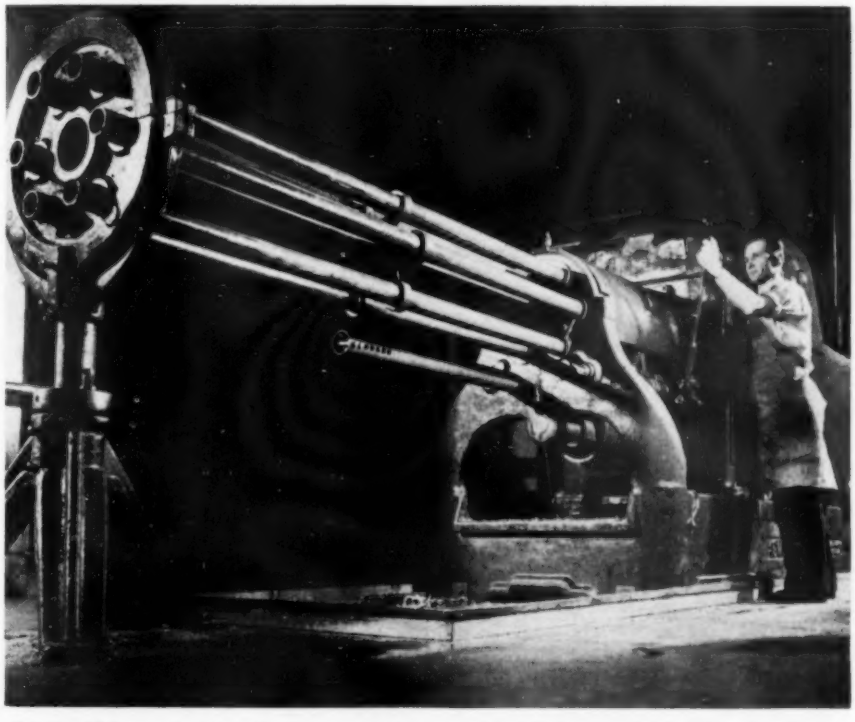
Very conscious of the political pressures involved, Selective Service would like to comb out its files of 4-F's or pull in the childless men over 38 before it gets to the fathers. But before it can do this, Army and Navy must cut physical standards and agree to take more men for limited service—which they resist stoutly.

JOHNSON NAMED CONSULTANT

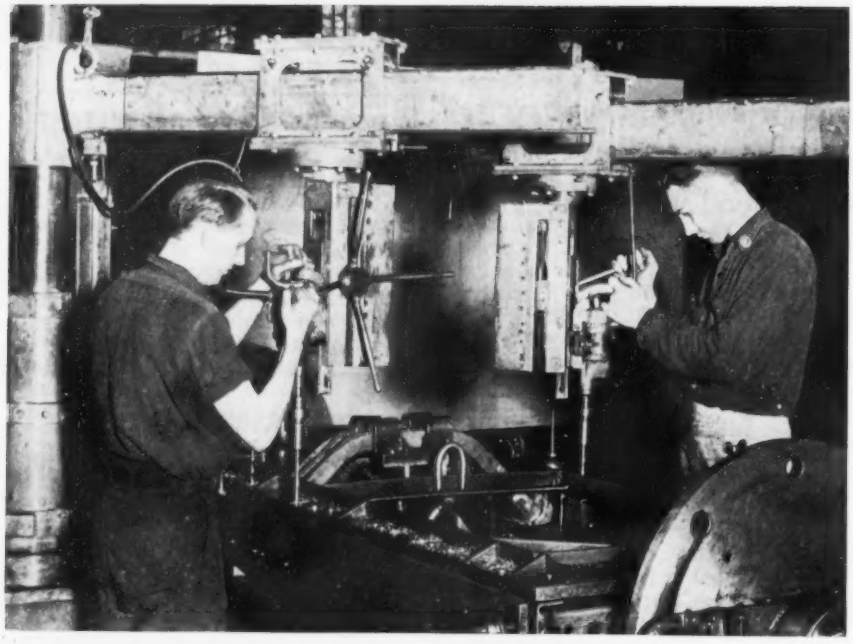
WASHINGTON—George Johnson, until recently chief of the Tools Division of WPB, has been appointed consultant on machine tools in the Facilities Bureau of WPB. His headquarters are in the Railroad Retirement Building, Washington. Mr. Johnson is president of the Gisholt Machine Co., Madison, Wis.

Byrnes Lessens Likelihood of Civilian Goods Production

WASHINGTON—The President's assignment of authority over production matters to Mobilizer Byrnes has drastically changed the prospects for civilian production. As long as Donald Nelson was boss, the view gained ground that munitions output is reaching the saturation point, that increasing amounts of materials can be released for civilian consumption, for maintenance of the civilian industrial plant. Byrnes, however, supports the Army view that with victory in sight now is the very time to go all-out on munitions, and to hell with the civilian. Byrnes' advisory board is stacked against Nelson, with Hopkins tending to side with Stimson and Knox. Appointment of Fred Searls this week as an assistant to Byrnes strengthens this tendency;



Ring Shooter—Aluminum rods loaded into this machine's six "barrels" change into rings the size of napkin holders when automatic drills, threaders and cutting tools go into action. More than 1,500 rings are produced in eight hours, each so perfect it checks to 0.0007 in.



Mother Necessity—When a light radial drill press was needed in a hurry at General Electric's Erie Works, recently, this machine was improvised by utilizing scrap materials and portable electric drills. Mounted on the radial arms by close fit, each head is positioned manually, and the drill is fed into the work by turning the hand-wheel. Hydraulic cylinders act as lifting screws. Weights over pulleys counterbalance the radial arms

Searls is a former member of the WPB planning committee who quit when Ferdinand Eberstadt, an Army proponent, was fired. So does the recognition given to Bernard Baruch, although this reflects his long association with Byrnes in South Carolina politics as much as it does policy.

Pushes Steel to Save Face

Reports in WPB are that Byrnes has ordered Nelson to restore to the Army, Navy, and Maritime Commission a million tons of steel cut from their third-quarter requirements. Since Nelson is anxious not to make a prestige issue of this attack on his jealously guarded power to allocate materials, his only out is somehow to produce a million more tons in the third quarter than was figured on when the allocations were made. The push is now on to do just that. Since February, Charles Wilson has been arguing that extra production could be achieved by pushing the furnaces harder, nearer to the danger point. The mills are now ready to give it a try. An effort will also be made to squeeze something out of hard-pressed consumer inventories.

At the same time that Nelson is thus surrounded, Byrnes is trying to head off WPB's congressional support. He has established close liaison with Senator Truman, who will clear future investigations with OWM before starting them. He is working out a similar arrangement with Rayburn in the House, which would stymie the Kilgore-Tolan crowd.

Allot Farm Machinery Steel On Basis of '40, '41 Output

WASHINGTON—WPB's allocation of 900,000 tons of steel for farm machinery for a full year ahead isn't expected to keep farmers quiet long, although the order allows production ranging from 23 percent of 1940's volume in less needed items to 240 percent of 1940 in those most needed. Farmers see the substantial income tax advantage to be derived from going in heavy for machinery now and the manufacturers and dealers will continue to press their demands.

Effective July 1, the new Limitation Order L-257 cuts short the life of its predecessor, L-170, by three months; however, it permits the uncompleted quotas under L-170 to be produced in addition to the quotas which it establishes.

The percentages for production quotas of specific items are worked out on the basis of an advance over-all authorization of 900,000 tons of carbon steel made to the industry for the period July 1, 1943 to June 30, 1944.

L-257 unlike L-170 contains no concentration provision but it does allow higher percentage for the production quotas of "small producers."

Based on '40, '41 Tonnage

The order permits a producer to manufacture any item of farm machinery and equipment for sale in the United States up to the percentage indicated for that item. These quota percentages are expressed in terms of the total net weight of the items manufactured by him during either 1940 or 1941, whichever was higher. Production of any item of farm machinery and equipment and repair parts must be in accordance with production schedules approved by the War Production Board.

Shipbuilding Emphasis Now On Speedier Victory Models

WASHINGTON—Turbine gear propulsion machinery has become available after a long period during which all such equipment went to the Navy and to the power industry, and the Maritime Commission has let contracts for 411 Victory ships in which turbines will replace the reciprocating steam power used in the Liberty fleet.

For more than a year the Commission has been striving to step up from the Liberty to a design that will be able to stay on the seas after the war, against competition. There is little doubt that many or all of the Liberty ships eventually will be tied up, as were the emergency ships after the first World War.

Now Stress Quality

The Victory model has 6,000 horsepower and can make 15 knots, as compared with the Liberty's 2,500 horsepower and 11 knots. The government considers its merchant marine battle against submarines so far won that it can now afford to spend more time building a better ship.

July 1 Advent of CMP Ousts Preference Rating System

WASHINGTON—The Controlled Materials Plan (CMP) goes into full effect July 1 and the steel and iron order M-21 has been amended accordingly. Mainly the change eliminates the preference rating system; until July 1, however, steel deliveries are permitted on a rating of A-10 or higher.

Under the amendment, steel products may be delivered only on authorized controlled materials orders; under priorities regulation No. 13; by CMP regulation No. 4; by orders M-21-b-1 and M-21-b-2; or as specially directed.

Covers All Steel Products

The new order applies to all steel products except for iron products and steel forgings which may still be delivered on A-10 or higher; under PR 13, or on special authorization. Second quality material and shearing of all types are covered, but not used or salvaged materials.

Method of identifying purchase orders is now in terms of CMP Claimant agencies, not group classifications. There are other orders than M-21 which still apply to steel production, distribution and use and all must be complied with except in so far as they are inconsistent with M-21.

INSIDE DETROIT

BY SILER FREEMAN

Auto makers plan for a quick return to peacetime status, while dreaming of an early peace. The helicopter has a prominent place in Detroit's postwar planning; Nash, in the van, has strengthened organization. Ford heads quit

Auto Makers Have Postwar Fever Postwar planning is in the air in Detroit. There is a definite feeling among automobile manufacturers that the long awaited day when they will be back in their old business of turning out millions of cars for the eager public is not far off. They even quote a high Washington official as stating that this fall, probably November, will see the European situation definitely cleared and the entire war over by 1945.

Whether it is this optimism or its own theory, the automotive industry is thinking of postwar manufacture. Packard started it off when George T. Christopher revealed a list of recommendations for clearing his plant of government-owned equipment and materials to make room for the automaking tools and machinery.

Committee Lays War-end Plans The Automotive Council was not slow to take this up. It announced the formation of a committee which is working on a proposed general termination agreement. Alvan Macauley, president of the Council, in announcing the committee, stressed that this was not entirely a postwar problem but an immediate one because of the many cancellations already received in recent months.

Said Macauley: "Postwar employment of hundreds of thousands of workers in the automotive industry alone will revolve about the termination of war contracts. The working capital of thousands of firms can be jeopardized if undue delay were encountered in making contract settlements."

Once Burned Twice Shy Many of the manufacturers still remember their unfortunate experiences after the last war, when cancellations caught them with millions in unfinished goods and raw materials; when experienced Army men, anxious to get back to civilian life, dumped the responsibility for looking after the unfinished goods and materials into the lap of some other officer, willing to take the responsibility and who probably did not know the why or wherefore. This caused endless delays in settlements.

But it will be different this time. The auto makers are planning far ahead. While concentrating on their war problems, they have kept a weather eye on the things to come. They have kept accurate track of where their machines and equipment, pooled in the war emergency, are today. They know how soon they can get them back and how quickly their subcontractors can get back into automotive production.

Federal Plans Are Necessary Now all that remains is that the machinery for government clearance can be set up. The gigantic task of taking out the special equipment and making room for the resumption of car manufacture can only be handled by taking steps now and passing such laws as may be necessary.

Clinics have been held with government and industry speakers to explain how it may be done. Another clinic, looking even farther, took up the matter of meeting the market demand for cars. It projected a six million-car year and what it would mean to the industry and brought out interesting possibilities. The actuality may even exceed their fondest dream of hungry buyers.

Detroit Is Sold The Helicopter Some time ago, Igor Sikorsky brought his movies of his famed helicopter to Detroit and excited much comment about the possibility of a new industry for Detroit. The helicopter, as a product of Detroit, seems now assured.

First, Nash-Kelvinator announced a contract to build helicopters for the government. That announcement confirmed a rumor that had been current for some time that George Mason, president of the corporation, was very much interested in that particular operation.

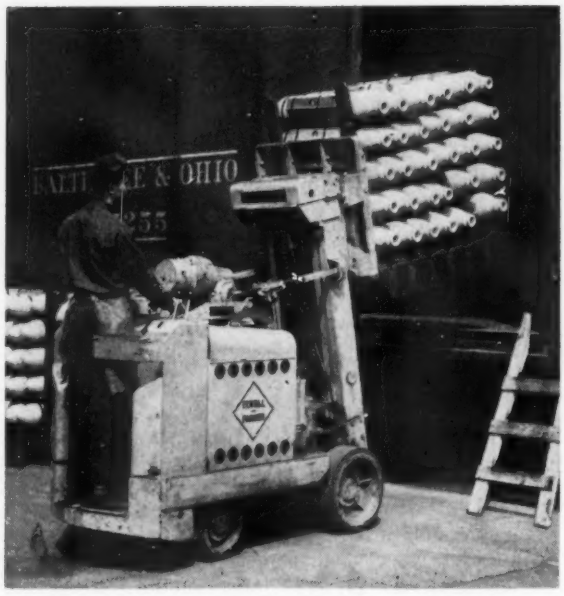
Enthusiasm Spreads Then came the further announcement that the Greyhound bus lines had applied to the Civil Aeronautics Board for a license to operate passenger helicopters throughout the United States over established routes, now covered by buses, and additional ones to be set up on the basis of service to outlying communities. Manfred Burleigh, president of the Great Lakes and Canadian lines of Greyhound, has been enthusiastic about the helicopter. He has been in the East many times, conferring with Sikorsky and watching the tests of the latest models.

Burleigh is convinced that the helicopter offers the newest mode of travel for the general public. He estimates that his company alone will use 1,000 helicopters after the war. Right now he will settle for two or three for experimental purposes.

But the market for Nash, if it continues in the business after the war, is already made. Hundreds here have expressed a great interest in the machine, for private use. It will be on the ground floor and with William D. Stout on the scene designing new models, the possibilities are vast.

Greyhound. Corporation's proposed

Author Sees Arsenal —Wendall Willkie, author of "One World," recently visited the Chrysler Tank Arsenal, donned coveralls to ride in a Gen. Sherman tank, was greeted by employees and, as shown in accompanying illustration, autographed a Dodge army truck



Stack of Grief—As part of the United Nations' preparations for retaliation, should the Axis resort to gas warfare, Enamel Products Co. switched from making porcelain enamel finishes for signs and washing machines to quantity production of bombs. Carloads of these bombs are being shipped to the east and west coasts for loading

application for a certificate to operate helicopter services after the war is termed "ridiculous" by sources inside the Civil Aeronautics Board. The board is irritated by repeated attempts to stake out claims for the future, after it has said that date of filing will establish no priority. Control of airlines by ground services also is publicly opposed by the board. But the point is, from the metal worker's angle, that the country has gone wild about direct lift flying.

Nash Staff Is Stronger

Late developments at Nash indicate that it will be different organization after the war. The addition of A. M. Wibel, former Ford executive, to the managerial staff is expected to strengthen it greatly. Wibel rose as an engineer and then as purchasing agent for Ford's. No one ever disputed his acumen in the purchasing field. He is destined for a big role in Nash-Kelvinator's future.

Then Mason has picked up the reins personally. Formerly he was content to sit back and operate through his department chiefs, such as Armstrong and Frank Pierce, both now resigned. Now Mason wants everything to go through him personally. He is a lot more active than he has been in the direction of the company.

Top Flight Men Leave Ford

Resignations in the top staff of Ford company continue. The latest is that of the plastic genius, Robert A. Boyer, chief of research. His resignation is effective July 1. At the same time, the soybean fibre mill was closed.

Boyer designed and built the first all-plastic car body. It came too late for development but was one of the things which the company was looking to after the war. Boyer has made no other connections, he said, and would vacation in Florida before making further plans.

N.I.A.A. Underscores Postwar Prosperity to Pay War Debts

CHICAGO—The National Industrial Advertisers Association has issued a Declaration of Postwar Principles, stating the ten basic principles upon which they feel a secure postwar economy can be built.

The Association declares that the maintenance of a high level of employment is the major responsibility of industry and that the only feasible means of paying huge war debts within a reasonable period of time is by the attainment of a high level of prosperity for everyone.

The National Industrial Advertisers Association comprises 27 chapters in major industrial cities throughout the country and Canada.

Technical Publishers Plan Visit to Latin Americas

NEW YORK—James S. Thompson, executive vice president of the McGraw-Hill Book Co., is one of the five publishers, representing all aspect of book publishing in the United States, who will make a trip to Mexico, Columbia, Peru, Chile, Argentina and Brazil the latter part of this month. Arranged under the auspices of the Department of State and the Office of the Coordinator of Inter-American Affairs, the trip has for its purpose the first-hand investigation of obstacles which have prevented an exchange of publications between the United States and the other American republics to the extent desired by persons in these countries.

Consultations will be held with publishers, book sellers, government officials concerned with education, cultural and commercial relations, librarians, officers of professional associations, directors of school and research centers, and prominent persons in all writing and publishing activities and educational circles. Prominent publishers from Latin-America have visited the United States recently.

The mission is expected to aid the immediate war effort, through facilitating the meeting of the south and central American demand for scientific and technical publications.

The publishers who will comprise this group were selected in consultation with the editor of the Publishers Weekly and others prominent in publishing and inter-American affairs. In addition to Mr. Thompson, they are George P. Brett, Jr., president of the Macmillan Co., Burr L. Chase, president of Silver Burdett Co., Robert F. DeGraff, president of Pocket Books, Inc., and Malcolm Johnson, executive vice president, Doubleday, Doran & Co.

WAR RULINGS IN BRIEF

Checklist of Significant Regulations on Materials and Prices

ARMOR PLATE—Rolled armor plate which is further processed by a controlled material producer or any other processor is a Class A product, whether shape is changed or not; while forged armor plate, irrespective of its form or shape, is a Class A product and not a controlled material. (Direction 10, CMP Regulation 1.)

BILLS OF MATERIALS—WPB field offices have available upon request revised booklet of instructions for preparing bills of materials under Controlled Materials Plan which clarifies the instructions and simplifies procedure in preparing proper bills.

FILES—Number of sizes in which rotary files are produced has been cut to 70. (Schedule 4, Limitation Order L-216.)

FLANGES—A mark-up of 11 percent over total production costs for cast steel, forged steel and steel plate flanges has been fixed as a maximum for new producers who use facilities of small foundries and machine shops on subcontracting basis. Amendment is applicable only for producers who prior to January 1, 1943 were not engaged in flange manufacturing, and who will sell and deliver before August 31. (Amendment 6, Order A-1, MPR 188.)

STEEL—Primary change effected by amendment covering distribution of steel and iron products is elimination of preference rating system as such for deliveries effective July 1. Under amended order steel products may be delivered only on authorized controlled material orders as permitted by Priorities Regulation 13, CMP 4, Orders M-21-b-1 and M-21-b-2. (Amendment to Preference Order M-21.)

VALVES—Parts and subassemblies as well as any operation performed in processing, machining, welding, treating or finishing of these steel products, when sold or performed by new subcontractors to and for valve manufacturers, have been exempted from price control. (Amendments 12 and 23, Revised Supplementary Regulations 1 and 11.)

WARTIME WASHINGTON

BY BLAINE STUBBLEFIELD

While encouraging greater production, procurement agencies are busily preparing machinery to cancel war contracts equitably when peace comes. When Hitler collapses, some cancellation will occur. Each agency has a formula.

Lay Plans for War Ending Now that the war production machine has been put together and is rolling as smoothly as it ever will, some of Washington's brainpower is at work on plans to take it apart. One of the biggest problems in the shift from war to peace is a formula for cancellation of war contracts.

The Procurement Policy Division of WPB and a joint committee representing Army, Navy, Maritime Commission and Treasury have been working toward a uniform contract termination clause for months. As the enemy's defeat draws nearer, producers of machine tools and munitions are increasingly concerned over the terms under which they will quit the battle of production.

At least two dozen drafts of a termination clause have been written. One of them, presumably the last one, has been circulated among federal executives and lawyers and among industrialists and labor leaders. Many suggestions have been offered and a new draft is being written.

Try Amicable Agreement First The circulated draft is still on the confidential list, but its content is widely known. In general, the clause provides that, if possible, the procurement agency and the contractor agree on a fair settlement, taking into account the work done, costs, and profits, and work in progress. If no agreement can be reached, then the formula is to be resorted to.

Services Have Different Views The contracting office is to have a fairly free hand, but the settlement is to be based on the termination formula. But the formula, because of the myriad considerations involved, can be nothing more specific than a statement of principle. Therefore, the termination-of-contract procedure, as it now appears, is nothing more or less than negotiation. In fact, the Army has taken a "realistic" viewpoint of the problem, to use Washington's favorite word, and is advocating the settlement of contracts by negotiation, one by one, and is placing little faith in any possible formula. Navy, on the other hand, is reported still hoping that a set of rules can be worked out.

Conversation with persons engaged in this project indicate that the end result will be some sort of compromise. There will be rules, but all of them can be interpreted in different ways, or ignored in special cases. The manufacturers, of course, will want special consideration for their own particular circumstances. It would be possible to give everybody a detailed hearing, but it would take longer than it did to fight the war. Contractors will take a slight trimming for a quick settlement, rather than haggle for months for moderate gains, especially those who see a hungry civilian market awaiting them.

World Situation A Big Factor Some industries that have poor peacetime prospects may not want to be checked out of government business; rather, they will prefer to taper off, going over to peacetime work by steps. No doubt some of them will take their termination checks and quit. It will be no simple matter to determine which industries and which companies to settle with first. In fact, some thought has been given to the drafting of a termination schedule, under which the war machine would be taken apart somewhat in the manner it was put together. This will depend upon the international setup when war ends: whether power politics and more war are in sight, or world government by court order and police force.

As discussion of a settlement formula goes ahead, it appears more likely that conflicting interests and opinions will require congress to step in as arbiter and pass some sort of legislation. Cooperation between industry and government will come less easy as the patriotic motive gives way to the peacetime profit motive. If congressional action should fall at an opportune time, party politicians will take a delaying hand. And if the enemy should fold up unexpectedly, as enemies often do, the country would be caught with no contract liquidation program, and have to work it out amid all the other hubbub on the road back.

Some Agencies Are Experienced The best school for composing termination clauses has been and is in the offices of procurement agencies who have had to issue stop orders. They have already wrestled with the problem of paying costs on completed goods, of accounting for expenses on work in progress, of allowances for profits, of settlements with subcontractors with whom the prime contractor has already negotiated a quitwork deal, plus intangible factors.

Each procurement agency has its own formula, and is constantly improving upon it. The agencies and their suppliers know each others' men and their methods. It could turn out that several formulæ would be better than one, with or without legislation.

Joint Committee Will Be Pushed A strong push behind the lagging program to install labor-management production committees in all war plants will be the first result of appointment of Joseph Keenan of A.F.L. as WPB vice chairman in charge of the production drive. Keenan's opposite number, Clinton Golden, of C.I.O., in his dual capacity as vice chairman of WPB and of WMC will handle liaison between the two agencies.

Mighty Midget—Col. Rene R. Studler, U. S. Army Ordnance Dept., demonstrates the Army's newest weapon, a "pocket-size" machine gun which fires 450 rounds of ammunition a minute. Known as the M-3 submachine gun, the .45 cal. weapon is quickly demountable and can be carried in a brief case. Note four empty ejected cartridges in mid-air behind Col. Studler

Press Assn.

SAE Hears of Problems Created By Mass Production of Materiel

DETROIT—Design and production defects are responsible for fully 90 percent of all fatigue failures occurring in service or during laboratory and road tests, the War Materiel Meeting of the Society of Automotive Engineers was told by J. O. Almen, General Motors Research Laboratory Division.

The meeting was held at the Book-Cadillac Hotel, here, June 9 and 10.

Present routine, Mr. Almen said, is such as to shift the blame for fatigue failures in automotive parts upon the metallurgists, who are better equipped for analysis and inclined to accept responsibilities which really should be borne by designers, engineers and production departments.

"It would be helpful," Mr. Almen stated, "if the metallurgists would be less willing to look for metallurgical causes of fatigue and insist that equally competent examination for mechanical causes be made. Until this is done, we cannot hope to make full use of our engineering materials."

Asks Better Motorized Design

Col. E. S. Van Deusen, Ordnance Department Tank-Automotive Center, made a plea for increased accessibility in motorized war equipment to save time and lives. He praised modern equipment as being superior to any previously available, but decried the tendency toward integral assemblies, crowded and shrouded engine spaces, and special tools for maintenance, adjustment, or repair jobs.

"The ideally designed vehicle," he declared, "is one which can be disassembled, assembled, serviced and adjusted completely by the use of human fingers, strength, and intelligence alone. Since this is obviously impractical, the goal for military purposes should be service ease requiring only a screwdriver, pliers, and possibly a single adjustable end wrench."

Substitute Materials Found

J. F. Bachman, of Chrysler Corp., said that tin-plated cast iron, tin-plated steel, and Durez plastic with hardened steel inserts satisfactorily will replace aluminum in the brake cylinder pistons of motor vehicles.

Tin-plated cast iron pistons were said to be most satisfactory alternates. The steel pistons create a difficult handling and inspection problem in that the slightest burr or nick may scratch the cylinder bore and cause leakage. The plastic and steel pistons were said to have no substantial background of experience.

Dust-Proofing Discussed

Desert warfare is partially responsible for the present interest in dust-proofing of vehicles. L. F. Overholt, of International Harvester Co., related how all the experience developed through the past 30 years by the tractor industry is being applied.

Auto Industry Praised

The automotive industry is producing airplanes for the U. S. Navy on a flexible, mass-production basis in the best tradition of an embattled America, Rear Admiral Ralph E. Davison reported at the dinner session. He praised the automotive industry's willingness to transform its operations to large-scale manufacturing of planes, and to learn and to exchange technical data.

Similar praise was extended to engineers and production men by Society President Mac Short, who lauded their voluntary and harmonious exchange of technical data. He said this had made it possible for large-scale production of war equipment to get under way.

Tank Engine Development Told

"The development of engines for tanks has been almost entirely a matter of adaptation of engines originally built for other uses," said Col. R. J. Icks, Ordnance Department. "There were many reasons for this condition, not the least of which was the lack of interest on the part of industry in developing a specialized engine for tanks in view of the limited orders which the prewar economy years permitted us to place. As matters turned out, it was just as well, in that we probably have been able to procure more tanks than we could have, had we been limited to one type of engine.

Canadian Government Extends Its Control of Machine Tools

OTTAWA—On and after July 1, all dealers in Canada in new or used machine tools must operate under license from Thomas Arnold, machine tools controller, the Munitions and Supply Department has announced. Applications for licenses are being made to the controller at 1020 Dominion Square Building, Montreal, Quebec.

Under the terms of the new order, the only free movement of machine tools after July 1 will be from a licensed dealer to a consumer. Except under permit from the controller, there shall be no movement of machine tools between dealers, or between consumers, or from a consumer to a dealer.

The order covers only power operated metal-working machine tools, not wood-working equipment. Excluded also are hand tools.

Under the order, except under permit, orders for machine tools for export may not be accepted, nor may anyone place an order for machine tools outside of Canada.

Limit Industrial Buying

OTTAWA—A new priority procedure, the Program Classification System, has been put into effect, according to announcement of the Munitions and Supply Department.

Under an order of Priorities Officer W. E. Uren, industrial purchasers of goods or commodities valued at $25 or more must classify their purchase orders within one or more of 24 Canadian code numbers. The new regulations apply only to purchase orders placed in Canada and do not affect retailers or those who buy from retailers. Industrial and mill suppliers, warehouses are affected.

Blade Coolers—Water-cooled, cast-to-form Meehanite dies are used by the American Propeller Corp. when quenching finished blades to final hardness. Cast closely to shape, the dies effected major economies by the elimination of considerable die sinking

SPOTTING THE AIR NEWS

Airplane production rises, but it is still not meeting the 1943 bogey. Helicopter program is stepped-up by war agencies. Development of huge planes goes on. Engine failures are being investigated by the Truman committee

Airplane production exceeded 7000 in May, and Charles E. Wilson, chief of the Aircraft Production Board calls for 8000 in June. Output of airplanes and airplane armanent increased 8 percent in April over March; heavy bombers were up 18 percent and single-engined Navy fighters nearly 50 percent. Total aircraft category expenditures in April was $1,649,000,000 which is about 33 percent of all munitions produced. Aircraft ordnance output increased about 14 percent in April, largely because of stepped up production of heavy bombs. Aircraft program looks good but we are behind the 1943 program. WPB frankly admits it will be difficult to catch up. In the first four months of the year only 19 percent of 1943 scheduled combat planes have been delivered, 20 percent of service planes, and 36 percent of trainers. The lag is caused by the increasingly broad shift to heavy bombers, which calls for the construction of plant additions and new plants.

Speed with which this additional plant is put into operation will determine whether we meet the 1943 quota—in terms of tons, not units. The program in tons has never been announced, but past production has been totaled up in tons, by the President himself. New disbalances in the flow of airplane parts and components continue to hamper deliveries; the current bottleneck is aluminum forgings, castings and extrustions.

Nash Kelvinator gets helicopter contract from United Aircraft. This is the second mass production order that has been made public. The first was several months ago when the original Army order went to Sikorsky Aircraft Division of United Aircraft. Technically, both the Nash-Kelvinator and Sikorsky contracts are subcontracts under United. Army's first order was for several hundred; the program probably stands in three figures now. The war agencies have decided the helicopter is a good anti-submarine weapon, because it can go along with ships like a mechanical seagul, peering down into the water for tin fish, and sitting down on almost any deck for fuel. New Liberty ship design provides a helicopter platform; old ones are being converted. War development will put the helicopter a long way toward readiness for the post war market.

Altitude trouble is dogging the world's air forces. A year ago Germany, England, the United States and no doubt other countries developed pressure cabins for bombers, adapting the work done by Boeing on the stratoliner, to maintain sea-level breathing for crews at any altitude. The British even supercharged the cockpit of a special Spitfire fighter. Pre-flight treatment of personnel going on high missions, and the oxygen harness they wear, seriously handicaps their work. Supercharging of crew compartments was and is a good idea, but it isn't panning out. Equipment required to pump the air and materials used to seal the cabin add too much weight. And when the ship is punctured by enemy fire the crew must grab their oxygen masks or dive for breathing levels, and feel lucky if none dies.

The Kaiser-Hughes cargo plane now building on the west coast is described for the first time in a report by OWI on air cargo present and future. Howard Hughes is a machine tool builder, sportsman, movie man, and plane designer, extensively responsible for the new Lockheed four-engined Excalibur. The Kaiser-Hughes ship is all ply-wood, powered by eight engines, and rated to carry 60 tons net, gross weight being 400,000 pounds. Its fuel capacity is 8000 gallons; average cruising speed, 174 m.p.h.; wing spread, 320 feet; length 218 feet. The only other airplane of similar size known to be in development is a 400-passenger-and-cargo ship now in the mockup stage at Consolidated. By some twist of government reasoning, the data is available on the Kaiser plane, which is under Army contract, while facts on the Consolidated, not under contract, are withheld.

Lockheed's "Constellation" C-69, originally designed as a passenger ship but now being tested as a troop carrier, is also described for the first time in OWI's report. It has four 2200 h.p. air-cooled engines; speed 225 miles per hour at sea level increasing to 300 m.p.h. at 19,000 feet altitude; gross weight 73,000 pounds; fuel capacity 4800 gallons; carries 55 passengers as high as 30,000 to 35,000 feet in a cabin sealed and supercharged for breathing comfort. This is the largest *land plane* in the United States. It can sustain flight at 25,000 feet on three engines, or on two engines at 16,000 feet. Glenn Martin's flying boat patrol bomber "Mars" which was begun about six years ago, and which is now being converted to

To the Shores of Italy?—The marines have an amphibious transport glider, America's newest invasion weapon, designed and produced of molded plywood for the U. S. Navy, by Allied Aviation Corp.

cargo use, is probably the largest airplane in this country, although the Army might argue for its B-19, only one of which was built, and which is about as old as the Mars.

Aircraft engine failures have caused too many Army Air Force accidents, according to reports in the hands of the Truman Committee investigating the conduct of the war. The committee will make no comment prior to issue of its report, some weeks hence. The War Department is cooperating fully with the committee, in fact is making a study and a report of its own. All of Truman's information goes to the Committee as fast as it is collected, so that such loss of life and property as was due to these engine failures is being curtailed now, not waiting for publication of the report. There are only three high-powered engines serving the Army and Navy: Pratt & Whitney, Wright Aeronautical, and Allison (Army only). Excessive engine failures were at first identified with faulty steel, but this was unofficial talk only. The Truman Committee's stated policy of trying to be entirely constructive is gaining credence throughout the country.

A. M. A. Reelects Heads

NEW YORK—William L. Batt, vice chairman of the War Production Board and president of SKF Industries, Inc., was returned to the chairmanship of the board of the American Management Association and Alvin E. Dodd was renamed president at a meeting, June 15, at the Hotel Pennsylvania.

President Dodd stated in his annual report that the Association's membership enrollment is the highest on record and that its publishing and research activity has been greatly expanded. He cited these as a "direct reflection on the growth of a national 'management consciousness.'"

While complimenting American companies for their excellent use of management "know how," he pointed out that all are not operating with equal efficiency and that "The whole job of war production is geared to the speed of the slowest producer. It is this slow producer who needs our help."

Material Command Publishes Supplementary Steel Chart

WASHINGTON—In answer to many requests from aircraft manufacturers and steel producers, the Material Command, Dayton, Ohio, has published a supplementary steel time chart.

This chart illustrates graphically the actual steps involved in the production of four types of aircraft alloy steel—billets, hot rolled bar, heat treated cold drawn bar, and sheet and strip. It shows the time cycles which a manufacturer must consider when scheduling his production program, and why some products require more time than others. It also shows the number of steps involved to convert heat-treated, cold-drawn bar from billets or hot rolled bar.

As in the case of the first two charts, this time cycle presupposes the absolute minimum time under the best possible conditions, and does not include delays caused by back log of orders, minimum melt requirements, carload lot shipment, credit details and many other restrictions or rejections.

Expanded Facilities—Manufacturing facilities of the Lycoming Division of the Aviation Corporation at Williamsport, Pa., have been expanded by the conversion into a modern machine plant of the factory formerly owned by the Keystone Silk Mill Co. The opening of this factory was marked by an inspection by a group of Lend-Lease, Army and company officials

Nomination of Officers is Announced by the A. S. T. M.

PHILADELPHIA—Nominations for officers of the American Society for Testing Materials, for 1943-1944 have been announced by that group. Official notice of election will be given at 46th annual meeting, Pittsburgh, June 30.

Nominated for president, to serve one year, is Dean Harvey, materials engineer, Westinghouse Electric & Mfg. Co.

Named for a two-year term as vice president is J. R. Townsend, materials standards engineer, Bell Telephone Laboratories.

To serve as members of the executive committee, there have been nominated: T. A. Boyd, head, Fuel Department, Research Laboratories Division, General Motors; W. H. Finkeldey, member of the firm of Singmaster and Breyer; E. W. McMullen, director of research, The Eagle-Picher Lead Co.; E. O. Rhodes, technical director, Tire and Chemical Division, Koppers Co.; and F. G. Tatnall, manager, Testing Equipment Dept., Baldwin-Southwark Division, The Baldwin Locomotive Works. Each will serve two years.

Management and Workers Receive "E" Merit Awards

WASHINGTON—Additional shipyards and manufacturing companies have been selected to receive the Maritime Commission's "M" pennant and Army-Navy "E" Award in recognition of outstanding performance on war work.

"M" Pennant

Air Reduction Co., Reading-Pratt & Cady Div., American Chain & Cable Co., Bevis Machine Co., Birmingham Tank Co., Leathem D. Smith Shipbuilding Co., Todd-Galveston Dry Dock Co., Union Metal Mfg. Co., Westinghouse Electric & Mfg. Co. Merchant Marine Div., Western Pipe & Steel Co.

"E" Awards

Agawam Aircraft Products, Inc., Alloy Steel Products Co., American Art Metals Co., American Locomotive Co. (Latrobe plant), American Well & Prospecting Co., Ampco Metal, Inc., Badger Meter Mfg. Co., Bridgeport Brass Co., Brown Steel Tank Co., Chambersburg Engineering Co., Cincinnati Ball Crank Co., Cleveland Tractor Co., Curtiss-Wright Corp., Deere & Co., Defiance Automatic Screw Co., Eagle Precision Tool & Die Co., Eastern Tool & Mfg. Co., Eclipse Counterbore Co., Evansville Ordnance Plant (Chrysler Div., Sunbeam Div.), Federal Cartridge Corp., Hardi-Tynes Mfg. Co., Improved Paper Machinery Corp., Jones & Laughlin Steel Corp., Link-Belt Co. (Ewart Wks.), Link-Belt Ordnance Co., Lombard Governor Corp., Lufkin Foundry & Machine Co.

Mall Tool Co., Maxim Silencer Co., Metal Specialty Co., National Malleable & Steel Castings Co., Northwestern Machine Corp., Parkersburg Rig & Reel Co., Philadelphia Gear Wks., Pittsburgh Lectromelt Furnace Corp., Pittsburgh Metallurgical Co., Quality Tool & Die Co., Republic Aircraft Products Div.

Aviation Corp., Republic Drill & Tool Co., Revere Copper & Brass, Inc., Rockford Drilling Machine Div. Borg-Warner Corp., Savannah Machine & Foundry Co., Sullivan Machinery Co. (Michigan City plant), Tappan Stove Co., Thomson Machine Co., Todd-Johnson Dry Docks, Inc., United States Rubber Co. (Eau Claire Ordnance plant), United Welding Co., F. W. Wakefield Brass Co., Wayne Pump Co., Western Machine Tool Wks., Westinghouse Electric & Mfg. Co. (Mansfield plant), Worcester Pressed Steel Co., Zimmerman Steel Casting Co.

Stockings for Blondes Sell Over a Million in Bonds

CHICAGO—Driving the bidding upward in a manner paralleling the rise of machine tool production during the last two years, those in attendance at the Memorial Day war bond auction of the Chicago Chapter of the Machinery Dealers National Association, purchased $1,750,000 in bonds, to get premiums varying from nylon stockings and compacts to welding machines, lathes, drill presses and other equipment. A box of nylon stockings went with the purchase of $11,000 in bonds, while another bidder invested $75,000 in bonds to get a $2,200 lathe.

Members of the chapter donated pieces of industrial machinery for the auction. Admission to the affair was by purchase of $1 worth of war stamps; purchase of a $25 bond entitled one to a reserve seat.

NAMES in the NEWS

L. C. Goad

L. C. Goad has been named vice president of General Motors Corp. In 1923 he entered the employ of Delco - Remy Co., producers of automotive starting, lighting and ignition equipment, at Anderson, Ind., and in 1933 Mr. Goad joined the A. C. Spark Plug Div. of General Motors Corp. in Flint, Mich., advancing to general manager of the Eastern Aircraft Div. at Linden, N. J., in January, 1942.

J. L. Trecker has been advanced to executive vice president of Kearney & Trecker Corp., machine tool manufacturers, Milwaukee, at a recent meeting of the stockholders. Other promotions include R. W. Burk as vice president in charge of sales, E. W. Trecker, vice president in charge of manufacturing, and J. B. Armitage, vice president in charge of engineering. Mr. J. L. Trecker joined the company in 1924 and has served as advertising manager and treasurer, becoming vice president in 1936. Mr. Burk has served in a sales capacity in the Detroit, Philadelphia and Milwaukee offices since his association with the company in 1927; while Mr. E. W. Trecker has worked in all departments of the machine shop and office. Mr. Armitage has been connected with Kearney & Trecker since 1920.

Receive Executive Promotions of Kearney & Trecker Corp.

J. L. Trecker

R. W. Burk

E. W. Trecker

J. B. Armitage

C. K. Swafford

C. K. Swafford, works manager of Gisholt Machine Co., Madison, Wis., manufacturers of turret, automatic lathes and balancing machines, was elected a vice president at a recent meeting of the board of directors. Mr. Swafford originally entered the employ of Gisholt in 1913, and during World War I he was transferred to other activities, returning to the company in 1930. He will also continue to serve as works manager.

Arnold Tietig III, formerly vice president and treasurer of Metal Specialties Co., Cincinnati, metal fabricators, has been named president of the company, and will also retain the position as treasurer.

Elvin E. Hallander has been named vice president of Star Electric Motor Co. and its affiliate, Star Equipment Corp., Bloomfield, N. J. Ivor C. Peterson has been named vice president in charge of sales. The appointments of Raymond E. Hollander as vice president in charge of planning and purchasing for the motor company, and Fred Eberhard as vice president and general manager of the equipment corporation have also been announced.

J. Y. Dahlstrand has been appointed vice president of Universal Gear Corp., Indianapolis. For the past five years he has been chief engineer and director of sales, and was previously connected with the Murray Iron Wks. Co., Burlington, Ia., Allis Chalmers Mfg. Co., Milwaukee, and Westinghouse Electric & Mfg. Co., E. Pittsburgh.

Hans Lasker has been advanced from factory manager of Republic Aviation Corp., Farmingdale, L. I., to the newly created position of works manager; while Henry MacDonald, formerly assistant factory manager, has been named works manager at the Evansville, Ind., manufacturing facility of the corporation. Irving Keough, who has been general superintendent, has been promoted to factory manager.

Albert V. Beet has been appointed general superintendent of Arrow Head Steel Products Co., Howell, Mich., manufacturers of pistons, rings, wristpins, sleeves, valves and springs. Mr. Beet was formerly in charge of this plant from 1915 to 1936, then he joined Thompson Products, Ltd., St. Catherine, Ont., where he was superintendent. From 1938 until last year he was superintendent of Howell Electric Motors Co., Howell, Mich.

Harris & Ewing

W. K. Cooper

W. K. Cooper, who was general manager of the Lycoming Div. of the Aviation Corp., Williamsport, Pa., for three years, and who has since been serving as general sales manager, has been appointed vice president in charge of sales. Previous to his affiliation with Lycoming Mr. Cooper was connected with the New York Shipbuilding Corp., one of the Aviation Corp.'s associated companies. His office will be in Washington, D. C.

August E. Klinger has become president of Buffalo Steel Co., maker of agricultural implements, fence posts and angles, Tonawanda, N. Y. He

joined the company in 1907 and has been vice president since 1931.

Henry C. Wheeler has become president and treasurer of the Acme Shear Co. of Bridgeport, Conn., makers of shears and scissors.

John S. Gregg has become district sales manager of the Cincinnati sales office of Inland Steel Co. in the Carew Tower Bldg. He joined the company in 1935 after being employed with the Moise Steel Co. of Milwaukee. He has been covering the Wisconsin territory for Inland Steel.

Ernest Reaney

Ernest Reaney of the O. K. Tool Co., Shelton, Conn., makers of precision tools, has been named vice president in charge of sales and engineering according to an announcement which was recently made by Frank J. Nevins, president of the company. Mr. Reaney has been connected with the organization for the past fifteen years.

E. J. Ellertson, purchasing agent for Caterpillar Tractor Co., Peoria, Ill., makers of diesel engines, tractors and road machinery, has been made general purchasing agent, a newly created position. W. H. Steele, who has been

Caterpillar Purchasing Agents

E. J. Ellertson

W. H. Steele

assistant purchasing agent since 1929, has been advanced to purchasing agent, with supervision over the entire Buying Div., succeeding Mr. Ellertson.

Edward Shaw, Sr., formerly New England sales representative for the Producto Machine Co., Bridgeport, Conn., gear cutting and milling machine firm, has joined Moore Special Tool Co., makers of jig borers, grinders and other precision tools, Bridgeport, as sales manager.

V. H. Peterson, for the past two years vice president of the Elliott Co., steam power specialties, Jeanette, Pa., has become assistant to the president of Baldwin Locomotive Wks., Philadelphia.

Thomas J. Connors has been named New York district sales manager for the Stanley Works, Steel Div., makers of electric portable tools. He has been a special representative for this division during the past 20 years.

George W. Person, formerly abrasive engineer in the St. Louis territory for Norton Co., Worcester, Mass., has become manager of the Abrasive Div. of Screw Machine Supply Co., one of the Norton Company's Chicago distributors.

BUSINESS ITEMS

D. K. Ballman

Dow Chemical Co. has formed a service and development division for the development of new chemical products in Midland, Mich. One of its major purposes is the study and further application of standard and new products to industry in the postwar world. The new division will also seek to promote a technical consulting service. It is being headed by Donald K. Ballman, who has been active in product development work with Dow for eight years.

Austin-Hastings Co., Machinery Div., Cambridge, Mass., machine tool distributor, has appointed Ralph L. Hohnhorst representative of the Connecticut district, with offices at 1753 Park St., Hartford, Conn.

McCullough Engineering Corp., manufacturers of superchargers in Milwaukee, has been acquired by Borg-Warner Corp. The company will continue to operate as a self-contained unit personnel, with Robert McCullough, present head and founder of the concern, remaining as president and director.

A. P. de Sanno & Son, Phoenixville, Pa., makers of grinding wheels and abrasive cut-off machines, has opened a Philadelphia office for the machine sales division and export department. In addition to the offices the company also maintains a large cut-off laboratory in the basement of the building.

Lempco Products, Inc., Bedford, Ohio, makers of axles, shafts, gears, grinders, has purchased the Evans Flexible Reamer Co. of Chicago. The company name has been changed to Evans

Evans Reamer & Machine Executives

James F. Strnad

O. T. Hillshafer

Reamer & Machine Co. James F. Strnad, president of Lempco Products is also president of the new corporation, and O. T. Hillshafer has been named executive vice president, having been assistant sales manager. He will make his headquarters in Chicago.

OBITUARIES

Maurice Lachman, inventor in the structural steel field and a pioneer in the development of electric welding, died in New York City at the age of 95. He held more than 100 patents in this country and abroad and worked on inventions until his last illness. Mr. Lachman was manager for 20 years of J. F. Pease & Co., a structural steel firm in Darlington, England; and had served as a consultant for the Blaw-Knox Co., a steel firm, of Pittsburgh.

I. L. Jennings, retired vice president of Lamson & Sessions Co., Cleveland, bolt and nut firm, passed away at the age of 58.

Robert Emerson Brown, Pacific Coast division manager of Electro Metallurgical Sales Corp., died at the age of 46 in Belmont, Calif. He began his association with units of Union Carbide & Carbon Corp. in 1920. At the time of his death Mr. Brown was also district sales manager for the Electrode Div. of National Carbon Co.

George L. Grimes, owner of the Grimes Molding Machine Co., Detroit, died at his home recently. He helped design the first castings on molding machines for multiple production at Ford Motor Co.

MEETINGS

American Society for Testing Materials. Annual meeting. Hotel William Penn, Pittsburgh, Pa. June 28-July 2.

Silver Bay Industrial Conference. Annual meeting. Silver Bay, N. Y. July 28-31.

SHOP EQUIPMENT NEWS

Gorton Makes American Model of Swiss Screw Machine For Turning Pinions, Shafts and Small Thin Parts

The 16-A precision automatic screw machine made by George Gorton Machine Co., Racine, Wis., is an American development of the well-known Swiss Petermann P-7 machine, which is particularly adapted to turning pinions, shafts, screws and small slender parts used in guns and aircraft engines and precision instruments. All tooling, vital parts and attachments on the Gorton 16-A and Petermann P-7 are interchangeable. The machine will handle diameters from 0.005 to 7/16 in., and lengths from 1/32 to 2¾ in. In addition to step and contour turning and chamfering, the machine automatically performs centering, drilling, threading and slotting operations.

Stock is fed to the five-station multiple toolhead by means of a cam, through a bushing, and past the cutting tools which are stationary in the horizontal plane. Thus, the side thrust of the tools is at the point of work support. The five tools on the toolhead are adjustable radially and axially by means of micrometer screws graduated in 0.0005 in. The toolholders will accommodate tools up to 5/16 in square. The two lower tool slides are mounted on a rocker which has a fixed ratio to the cams of 3:1. The cam to work ratio of the other three tool slides is variable from 2:1 to 3:1.

The spindle is fitted with an Ampco bronze tapered bushing with preloaded precision ball thrust bearings. The entire assembly is inclosed in the semi-nickel steel headstock mounted in a scraped and gibbed slide on the bed. Tool marks on the work are eliminated by the flat endless woven drive belt. Stock is fed through the guide bushing into the tools, longitudinal feeds being accomplished by feeding the headstock forward as a unit, with the bar held in the spindle collet in the usual manner. The Planex cam controls these movements forward and back. Synchronizing this longitudinal cam movement with cams which control the lateral movement of the tools permits generating any desired shape with single point tools. A hand wheel is provided at the front of the machine to disengage the camshaft drive and provide manual control for set-ups. Electrical interlocks prevent camshaft motion when the spindle is not turning, thus eliminating the possibility of tool breakage.

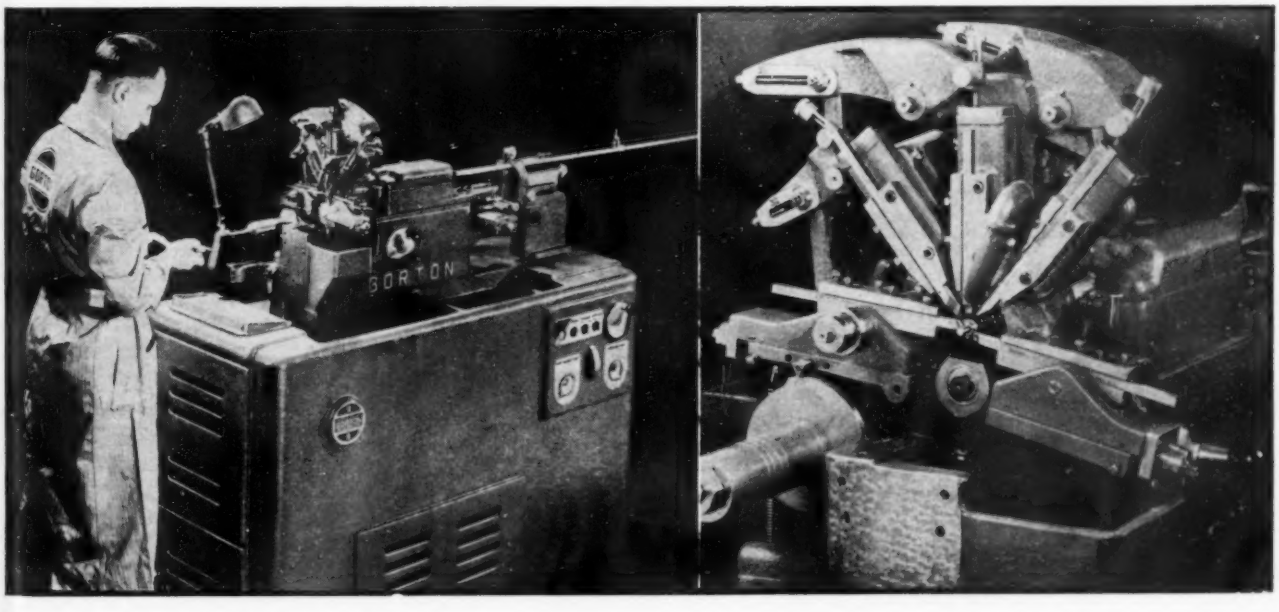
All functions of the screw machine are controlled directly from the centralized fingertip control panel located on the front of the machine. A start-stop switch for the spindle and camshaft motors, on-off switch for coolant pump, spindle and camshaft speed range selectors, are included on the panel. Spindle speeds can be instantly changed by turning the regulator wheel. Camshaft speeds are also controlled by a regulator wheel and can be increased or decreased while the job is running. Spindle speed variations from 1,100 to 10,000 r.p.m. are provided by a Reeves variable-speed drive. A two-speed ball bearing motor drives the spindle through this unit.

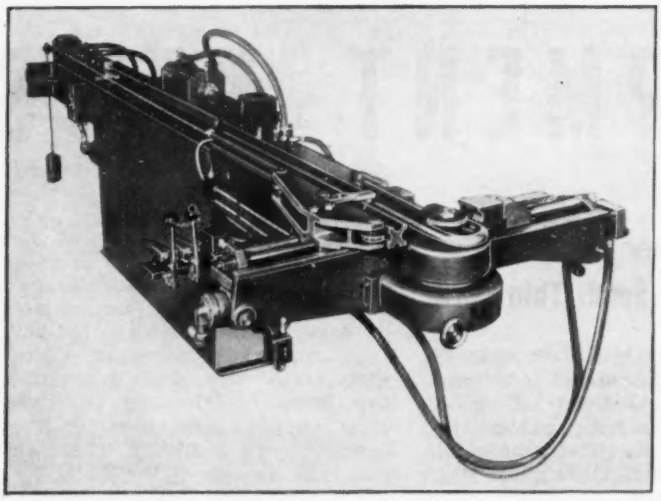
All cams are mounted on a single shaft at the rear. Quickly removable cam spacers for locating attachment cams are positioned on camshaft extension at the front end. The Planex cam is at the rear of the shaft.

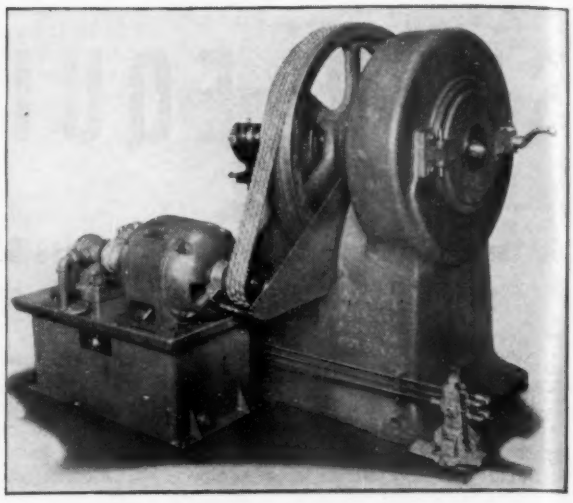
The Graham variable-speed unit provides infinite variation in camshaft feeds. A choice of low range camshaft speed dial allows 20 to 720 pieces per hr., or high range 20 to 1,440 pieces per hr. The camshaft is driven by a ⅓ hp. motor.

The coolant pump and ¼ hp. motor are mounted as a unit in a separate compartment at the rear of the machine. This machine is furnished with weight-operated bar feed.

The three spindle attachment, which mounts on the base in front of the tool frame, centers, drills and threads the piece either internally or externally. The threading spindles work on a speed differential system, eliminating necessity of stopping the work spindle, or of providing special headstock speeds for threading operations. A built-in automatic five-digit counter registers production quantities, and a stock supply signal automatically stops the machine when the stock limit is exceeded, and flashes a red light indicating that restocking is necessary. The machine is provided with an extension service light and a machine lamp on an extension arm with swivels, adjustable to any position.

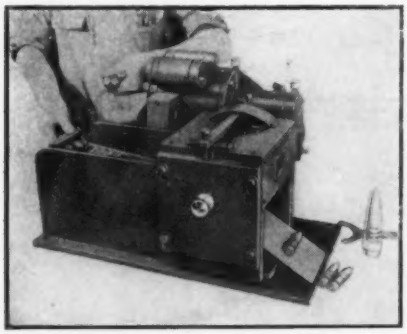






Pines Hydraulic Bender Has a Booster Attachment

The line of hydraulic bending machines made by Pines Engineering Co., Aurora, Ill., now includes a booster attachment in the form of a separate cylinder through which the mandrel rod passes. As the tube advances on the mandrel during the bending operation, the booster cylinder applies pressure to the rear end of the tube and relieves tension ordinarily required to draw the tubing off the mandrel from the portion of the tube already bent. By relieving this tension, the booster attachment permits bends to be made with a radius which will allow the stretching of the metal up to its maximum elongation. Another advantage of this attachment is that by allowing the pressure on the end of the tube to continue after the tube is unclamped in the bending dies, the tube that has been bent is automatically removed from the machine.



Acromark Cylinder Marker Die-Cuts Four Lines of Type

The Model 12B shell or cylinder marking machine, developed by Acromark Co., 7-13 Morrell St., Elizabeth, N. J., marks 20 mm. shot, but can be adapted to other similar products made of copper, brass, or unhardened steel. The machine is driven by a gear reduction motor.

This marking unit places an identification number, code stamp, or other markings into four lines of type or their equivalent in ⅛-in. letters, and die-cuts the marking on the product. With a simple adjustment for each variation in dimension, this machine will mark products of varied sizes and lengths. Each product is fed automatically from the chute to the die by a positive arrangement.

Stackbin Spare Parts Box Offered in Variety of Sizes

A spare parts box, available in a variety of sizes and styles to meet many different requirements of plants shipping parts with their products for military use, is offered by Stackbin Corp., 42 Troy St., Providence, R. I. The box is of all-welded construction and is equipped with a cover, hasp, and handles on each side.

Bunatol Adhesive Coating Protects Anodizing Racks

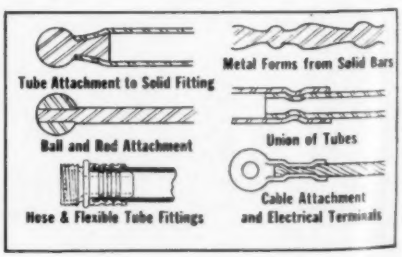
An insulant known as Bunatol has been developed by Nelson J. Quinn Co., Toledo, Ohio, for use in protecting sulphuric or chromic process anodizing racks to provide longer life. This tough adhesive coating has a flexibility in keeping with that of the spring-clip type of anodizing rack illustrated, and does not become brittle, crack or peel when the clips are flexed. Therefore, maximum rack protection is provided until the contacts are entirely eaten away.

Standard Machinery Hydro-Former Extends Range of Swaging Process

Standard Machinery Co., Providence, R. I., has brought out a Hydro-Former which will join and shape tubing and rod or hose and cable provided the parts are of circumferential section. It is made in three sizes, the No. 1 machine of the bench type that actuates the wedges manually instead of hydraulically. This model is limited to a ¼ in. diameter tube, or ⅛ in. solid, and has been designed primarily for the attachment of electrical fittings onto standard forms of solid and stranded copper wire. The die size is ¾×½ in. and ⅜ in. high. A ½-hp. motor drives the machine at 1,800 r.p.m. Weight of the No. 1 Hydro-Former is 140 lb.

The No. 2 machine performs on a 1-in. diameter tube, or ½ in. solid, and has a die 4×2 11/16 in. and 1 15/16 in. high, operates by a 10 hp. motor at 1,800 r.p.m. and weighs 3,300 lb. It requires a floor space of 48×60 in. Tubes of 6-in. diameter or 3¾ in. solid can be accommodated on the No. 3 machine, which has a die 8×7 in. and 4¾ in. high, and operates by a 40-hp. motor at 900 r.p.m., weighs 27,100 lb., requiring a floor space 90×83 in.

Six basic combinations of work that can be performed on this Hydro-Former are shown in the accompanying drawing. The basis of the action of the machine is the principal of flowing metal with the use of light blows rapidly and accumulatively. The pressures are accumulated irrespective of the shape of the die by injecting a tapered wedge between the back of the die and the hammer. These wedges


Tube Attachment to Solid Fitting
Metal Forms from Solid Bars
Ball and Rod Attachment
Union of Tubes
Hose & Flexible Tube Fittings
Cable Attachment and Electrical Terminals

63% of the CARBOLOY TRADEMARK CEMENTED CARBIDE produced today for machining purposes is used for Cutting STEEL!

CARBOLOY IS THE REGISTERED TRADEMARK OF CARBOLOY COMPANY, INC.

"Ploughing" through tough cast armor plate at cuts up to 1 in. deep—drilling gun barrels—cutting off shell—taking interrupted cuts through sand holes and scale—producing a quality of finish on critical parts often impossible to obtain with former tools—holding close tolerances that drastically reduce and often entirely eliminate subsequent grinding—making steels of 400 to 500 Brinell machineable—these are typical of the present day uses of Carboloy cemented carbide tools for cutting steel.

Today 63% of all Carboloy cemented carbides produced by Carboloy Company for machining applications are steel cutting grades. You'll find them in practically every major war plant throughout the nation, turning out steel parts for war at speeds 4 to 5 times faster than former tool materials, staying sharp up to 10 times longer—increasing production often as much as 300% on the thousands of applications upon which victory depends.

Write today for catalog GT-142 listing Carboloy cemented carbide grades for cutting steel, cast iron and non-ferrous metals available in more than 300 standard Carboloy tools and blanks.

Are You Using The Right Chip Breaker?

A special film available on design and grinding of chip breakers for carbide tools. One of a series of six films on Design, Brazing, Application and Grinding of carbide tools for use in your training program. Write for folder GT-151.

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Sole makers of the Carboloy brand of cemented carbides

Birmingham, Ala. • Chicago • Cleveland • Los Angeles • Newark • Philadelphia • Pittsburgh • Seattle

Canadian Distributor: Canadian General Electric Co., Ltd., Toronto, Canada. *Foreign Distributor:* International General Electric Co., Schenectady, N. Y.

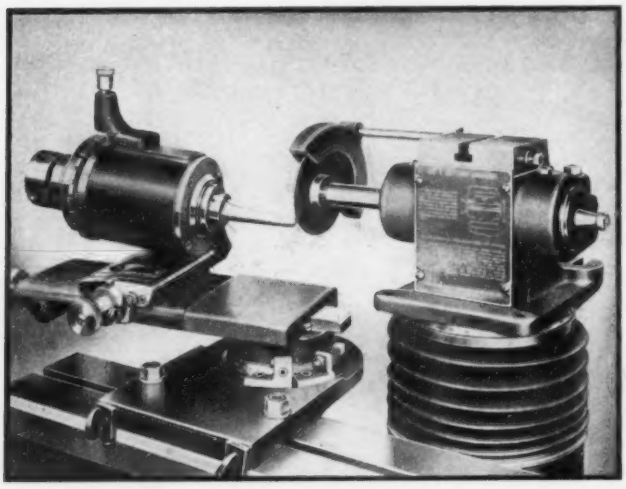
CARBOLOY TRADEMARK

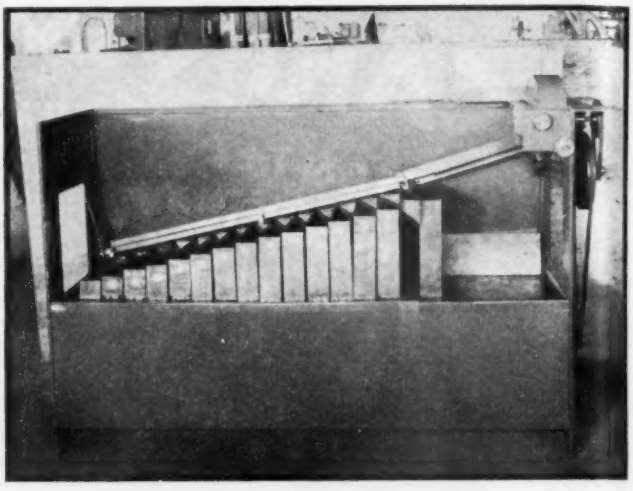
TITANIUM CARBIDES
TANTALUM CARBIDES
TUNGSTEN CARBIDES

are moved into position hydraulically at uniform pressures and variable speed, leaving the finished circumference smooth, without a seam on the outer part or a void between the two pieces. A uniform tight fitting can be made of a metallic coupling onto a rubber or canvas hose. The hammering action develops a uniform bond in the joint. The strands of wire, for example, are actually hammered into the inside diameter of the fittings.

A pair of split dies is prepared to the dimensions of the finished forms, placed in the machine, and a push-button depressed. As soon as the flywheel of the Hydro-Former is rotating, the dies are thrown apart and the work is ready to be placed between the dies for the forming. The wedges are then started into action by a treadle. When the forming operation is finished, another pressure on the treadle withdraws the wedges and opens the dies.

Where it is necessary to perform an operation in the center of a piece of tubing 10 ft. long, one 5-ft. end is placed through the spindle of the machine and contacting a stop. In the case of the ball fitting on a shaft, a stop can be arranged at any point on the die. Arrangements can be made also to combine the valving operation with the stop so that when the work is in proper position for forming the wedges will automatically come into play and withdraw after reaching the limit set for them.





Cincinnati Grinder Attachment Sharpens Various Type Cutters

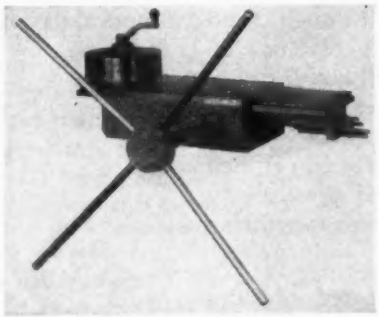
A handy device for sharpening die sinking cutters, ball-end cutters and double-end cutters is the No. 1 radius grinding attachment made by Cincinnati Milling Machine Co., Cincinnati, Ohio, for use on its No. 2 cutter and tool grinder. It has a capacity up to 3 in. diameter ballnose. The attachment is provided with two slides, each having longitudinal and transverse adjustment of the work with respect to the grinding wheel. A large diameter anti-friction pivot in the base promotes smooth and uniform swivel motion and is arranged so that the slide may be swiveled as a unit through 360 deg. Movable stops having screw adjustments which accurately limit the swivel motion to the desired amount have been incorporated in the base.

The index plate at the rear of the work-head spindle has 24 notches. With this device, the attachment will handle straight flute cutters having 1, 2, 3, 4, 6, 8, 12 and 24 flutes, without the necessity of a tooth rest. The universal tooth rest supplied with the machine may be used when grinding cutters with helical flutes.

Taper collets, for insertion in the taper hole of the spindle, are available for grinding taper shank cutters, while straight shank cutters are ground with the aid of adapters and sleeves. A stop collar device for straight shank cutter equipment enables the operator to quickly remove small cutters under 1½ in. diameter for inspection.

The attachment work-head has clearance setting dials stamped with large graduations on either side of the zero mark.

A wide selection of accessory equipment includes a motor for grinding cylindrical parts, collets and a sleeve for grinding straight shank cutters ranging from ⅛ to 1¼ in. shank diameter and collets for grinding taper shank cutters ranging from No. 4 to 11 B.&S. shanks.



United Turret Attachment Provides Hand Screw Device

A turret attachment that converts an engine lathe into a hand screw machine has been introduced by the United Industries, 4 East Buena Vista Ave., Detroit, Mich. The attachment is made standard for 10, 12, 14 and 16 in. lathes. The turrets are six-station, with automatic stops for each station. The tool turret is furnished blank to allow accurate alignment in boring on assembly. The device is self-indexing and is provided with adjustable screw stops and is installed on the ways by removing the tailstock.

Engel Rivet Sorting Machines Sort by Length, Head, Diameter

Rivets, screws or bolts can be sorted by length, head or diameter with the rivet sorters produced by Engel Aircraft Specialties, Escondido, Calif. The machines can be obtained in single or multi-unit sorters and in several models, having capacities up to 50 lb. per hr. for the single unit and 100 to 200 lb. per hr. for diameter sorting. They will do rough, general sorting of such parts made of Dural, steel or other metal alloys, or can be developed to do fine breakdown work.

Harnischfeger Electrode Developed for A. C. Welders

An all-position electrode has been designed by Harnischfeger Corp., Milwaukee, Wis., for use with alternating current transformer welding machines. It is made in ⅛, 5/32, 3/16, ¼, 5/16 in. diameters, 14 and 18 in. lengths, and is suited for all mild steel applications. These electrodes are packed in 50 lb. containers.

Den-Tex Hand Cream Compound Removes Paint and Lacquer

For removing paint and lacquer from the hands, Dennis Chemical Co., 2701 Papin St., St. Louis, Mo., has available Den-Tex cream compound. This material is said to be non-irritating and non-explosive. It is worked into the paint or lacquer on the hands and rinsed off with water.

An air-minded world waits for wings

BECAUSE of the airplane, the peace to come can be as global as the war. Trade and transportation will move freely to peoples never before a part of the world's markets. Millions to whom modern life is unknown have already met and understood the airplane. Like all of us, they will welcome its cargoes.

Such an opportunity can help maintain a war-size aircraft industry. The largest warplanes, the speediest bombers, may be inadequate for coming needs of passengers, mail, air express and freight.

The air industry can plan for an era of conversion and new production with a freedom in one way unknown. Materials will be available in almost endless quantity and variety. Revere alone will be ready with all forms of copper, as well as with gifted new alloys. But which metal should be used for what? The choice may not be easy.

For impartial answers to questions about metals, industry can turn to Revere. For just as industry in the future will not be restricted to the traditional materials, neither will Revere. Since the start of the war, in addition to widening still further the uses for copper and its alloys, Revere has developed facilities for manufacture of the light metals, and is pioneering in the production of wholly new alloys that can cut manufacturing costs for many industries.

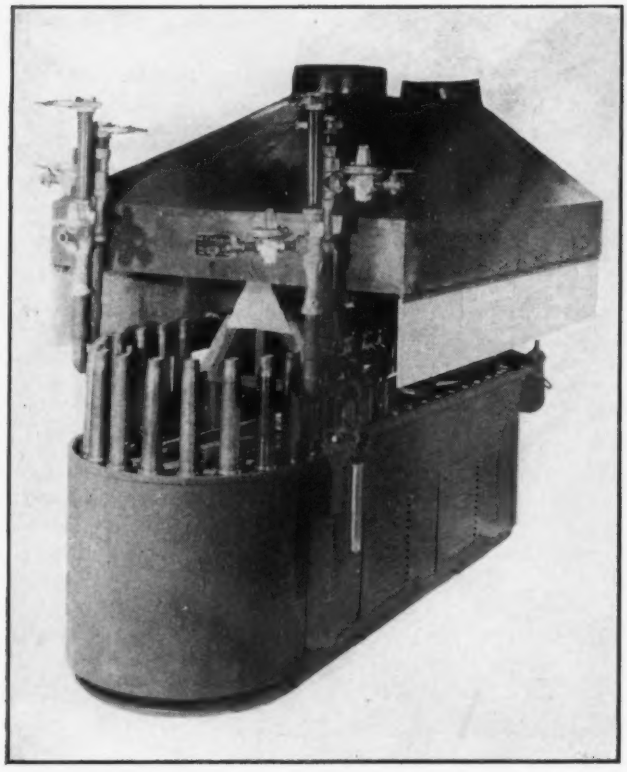
Today the copper industry is producing all-out for war. No copper is available for any other use. But post-war planners with specific problems in metals are referred directly to the Revere Executive Offices in New York.

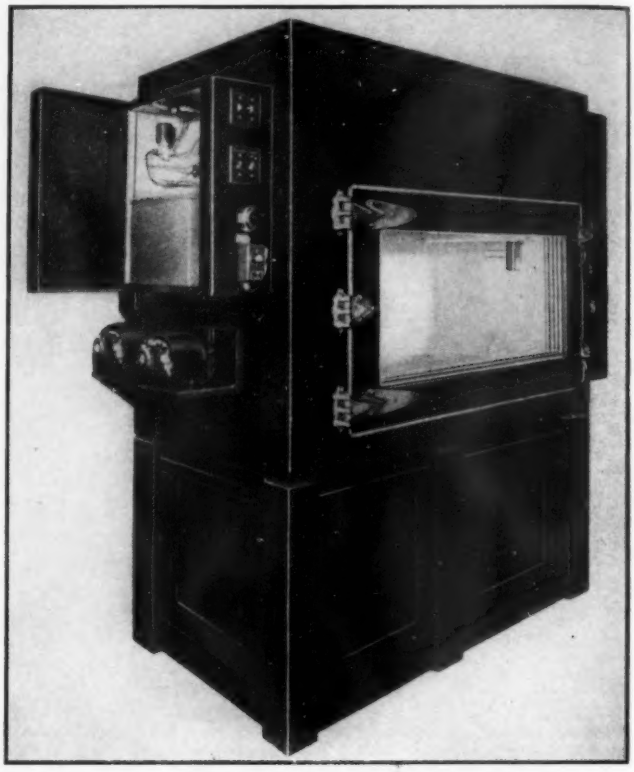
REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

Executive Offices: 230 Park Ave., New York





Morrison Shell Case Machines Do Mouth and Body Annealing

A flame type mouth and body annealing machine, developed by Morrison Engineering Co., Cleveland, Ohio is produced in three models for handling 37 and 40 mm. steel cartridge cases, 57, 75 and 105 mm. cases, and another model which handles 90 mm. and 3 in. anti-aircraft cases. Production varies from 400 to 2,000 cases per hr.

A steel conveyor chain placed on its side is driven by a variable speed drive through a totally inclosed worm gear reducer. This chain carries double row—ball-bearing mounted spindles every pitch. These spindles, in the form of a V-belt pulley, are rotated by a V-belt backed up by adjustable ball-bearing wheels, or in certain sizes and models, the spindles are sprocket equipped and driven by an adjustable steel roller chain. The spindle rotating mechanism is driven by a separate motor, provided with its own variable-speed unit and a totally inclosed worm gear speed reducer.

Work holder adapters are bolted on top of the rotating spindles and are interchangeable for different size cases.

The burner equipment is of blast line type with zero governors and proportional mixers provided for each burner. Manometers are also provided for each burner so that when once a satisfactory adjustment of the burners is attained, and the mixture pressure observed on the manometer, this same burner setting can be duplicated at any time. By operating at comparatively high mixture pressures and by rotating the work from 60 to 100 r.p.m. in front of the burners, fast heating is attained. The burners are adjusted and arranged to provide a holding or soaking zone, in addition to the heating zone. Burner equipment may be supplied with height adjustments when cases of different sizes are annealed in one machine.

Loading and unloading is a continuous manual operation at one end of the machine. A sheet metal hood with a vent connection incloses the operating mechanism; and hinged sides permit easy burner adjustment.

Sylvania Offers Glow-Type Fluorescent Lamp Starter

Glostat, a glow-type fluorescent starter, is being offered by Sylvania Electric Products, Inc., Lighting Div., Salem, Mass. The lamp starter is available

in two sizes, one for 15 and 20 watt lamps, and the other for 30 and 40 watt lamps. The construction of the starter allows severe punishment from a failed lamp, and it is said to have long life in service.

Amcoil Humidity Control For Refrigeration Equipment

The Amcoil low and high temperature test chamber is now made with automatic humidity control by American Coils Co., 25-27 Lexington St., Newark, N. J. The unit has the standard refrigeration equipment, featuring the test chamber and the attachment for humidity control. Humidity range is ambient to 140 F. It provides a temperature range from —67 to +160 F. A two-stage condensing unit and refrigeration accessory development make possible flexible operation at various loads and temperatures.

The exterior over-all measurements are 95 in. wide, 42 in. deep and 91 in. high. Observation of the products under test is provided by a door having five sealed and dehydrated panels of glass. The interior usable space is 52 in. wide, 30 in. deep and 27½ in. high. Positive forced air circulation that can be varied in volume and temperatures with thermostatic control provide a dependable unit for tests on delicate mechanisms. Shipping weight of this unit is 3,150 lb.

Maas & Waldstein Finishes Cover Surface in Single Coat

Maas & Waldstein Co., 438 Riverside Drive, Newark, N. J., has a line of Victory wrinkle finishes which contain no Chinawood oil, but closely resembling the standard finishes. These finishes form hard, durable coatings, cover rough metal surfaces in a single coat and are applied in regular wrinkle patterns by the same methods. They are obtainable in a full range of colors.

Why Does a Cutting Fluid Work?

A statement of tremendous importance to all interested in metal machining

TO DEVELOP NEW and greatly improved types of cutting fluids—made possible by increased knowledge of the chemical and physical functions of such materials—has been the aim of Quaker Chemical Products Corporation ever since we were convinced that the current knowledge of such products was, and still is, in its infancy.

Much has been written about fatty oils, sulphurized fatty oils, sulphurized mineral oils, chlorinated fatty oils and mixtures of all of these. But a close study shows many inconsistencies and a lack of definite *knowledge*. A great many statements made were based upon *theory* . . . or intelligent guesses.

So, some years ago we set aside a portion of our research laboratory, picked three outstanding men from our own research staff and assigned to them the task of replacing these theories and guesses with definite scientific knowledge.

Obviously, if we could find out just exactly what is needed to lubricate and cool a cutting tool and could measure this in the laboratory, the entire field would progress by leaps and bounds. Naturally, we have not yet learned all the answers . . . nor can we yet effectively measure in the laboratory just what a cutting fluid will do in practice . . . but we *have* taken many long steps toward our ultimate goal.

Sulphurized . . . But How?

When harder steels, tougher cuts and higher speeds made it necessary to improve the quality of mineral lard oil, the addition of sulphur constituted the first real advance. A little later sulphur was cooked into a combination of mineral, animal and vegetable oils. These sulphurized fatty-mineral oil combinations turned out cooler and better work than mineral lard oils or plain sulphurized mineral oil.

But our laboratory studies opened up another important angle. It soon became evident that it wasn't only the *amount of sulphur* or the *kind of fat sulphurized* that determined results. **The sulphur must be combined in just the right way, so that it will be *released gradually* . . . only to the extent required to prevent metal-to-metal contact . . . otherwise the sulphur content of the oil is rapidly exhausted and tool life is materially shortened.**

Thus, it is not sufficient to distinguish between "free", "combined" and "active" sulphur in cutting oils. The *rate of release* of the combined sulphur is of principal importance and can be determined only by practical machining tests . . . and not by any of the laboratory methods, such as the copper test, now in vogue.

New Process of Polymerization Found Effective

Further research in methods of combining sulphur led us into the treatment of fats and fatty waxes not heretofore used in cutting fluids. These were treated differently —by *polymerization* or a building up of the molecules. Next we found that *high pressure* and the use of a *catalyst* gave even better results. **Finally our laboratory succeeded in producing a sulphurized, polymerized fatty wax which not only permits the sulphur to be released over an extended period of time but which also possesses extreme pressure properties as well as excellent lubricating, cooling and anti-weld qualities.**

What This New Type Product Does

Primarily, this new material is a "base". That is, it is a concentrated product that must be blended with a vehicle such as ordinary mineral oil. When diluted in this manner, this advanced type of cutting fluid replaces present types of ordinary sulphurized cutting oils.

Numerous reports in our files attest to the considerably increased production being achieved in many plants with this new product which makes possible greater speeds and feeds . . . with longer runs between tool changes. On a difficult cutting operation where tools are being changed once or even twice during an eight-hour shift, it is quite common for a **Quaker Process Engineer** to put this new product on the job and entirely *eliminate* these tool changes *during* shifts . . . enabling them to be made *between* shifts only. This often means a saving of almost an hour per machine per shift. Think what this can mean both in the saving of hard-to-get tools and also in terms of increased production of parts for the planes, guns and tanks needed to speed the day of Victory!

Production Data Available

Authentic plant production data sheets containing complete figures on various machining operations with this new cutting base are available on request. They are actual reports from **Quaker Process Engineers** in the field and contain no advertising or "sales talk".

If you care to know more about how this new product can be of value to you, we suggest that you have a talk with a Quaker Process Engineer. These men speak your language and know how to translate our new developments into increased production in your plant. Please don't confuse them with ordinary salesmen—for before they came with us these men "cut their eye teeth" as factory chemists, metallurgists, methods engineers, or superintendents of industries such as yours. They are familiar with production problems—they deal with known facts—and they speak with authority. If you'd like to talk shop with such a man, write or wire us today.

QUAKER CHEMICAL PRODUCTS CORP.

CONSHOHOCKEN, PA.

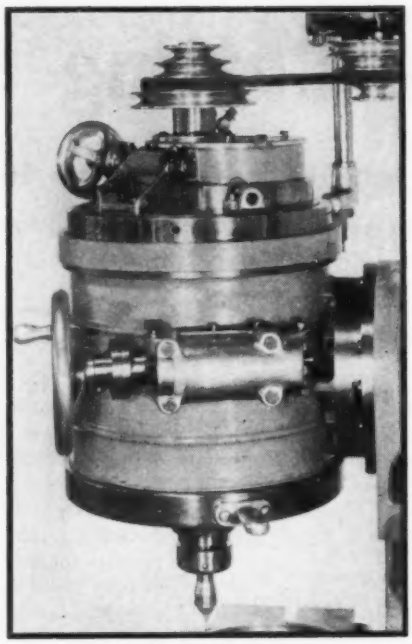
Allis-Chalmers A. C. Welder Provides Automatic Voltage

The Ampac 200 alternating current welder, which has been introduced by Allis-Chalmers Manufacturing Co., Milwaukee, Wis., automatically gives the operator correct voltage for the continuous range of currents available, instead of using an almost constant voltage at all current settings. This adjustment not only makes welding easy at low currents, but saves power when welding at high current because the voltage is low. Other features of this machine include integrated reactor-transformer construction, and simplified construction using fewer working parts. Range of current available in this machine is from 30 to 250 amp. It will handle rods 1/16 to ¼ in., for thin sheets or heavier plates. Because of the welder's unusual arc stability, most direct current rods as well as all alternating current rods can be used.

Protex Paper Sealer and Wax Protect Packages for Export

A paper sealer for export shipment is available from Wayne Chemical Products Co., 9603 Copeland St., Detroit, Mich. It is an adhesive in solid form and requires heating from 150 to 160 F. to liquefy it for application. This protex sealer is usually brushed hot on flaps of packages. The product is packed in 5 gal. steel pails. Pails may be placed on a gas flame or hot plate to liquify the sealer.

The company also has available a No. 8 Protex wax, a waterproof coating for dipping paper packages after wrapping. It requires heating from 150 to 160 F. for liquifying. The wax is packed in wooden barrels holding between 55 and 60 gal. This product is not as adhesive as the paper sealer.



Matthew Rotary Tool Carrier Contour Mills at One Setting

At one setting of the work on the table, a complex job of contour milling can be handled by the Matthew rotary tool carrier built by Production Machinery Development Co., 4845-49 St. Aubin Ave., Detroit, Mich. This device is a universally mounted rotary toolhead that avoids the need for a rotary table, and can be fitted to any horizontal miller.

The Matthew head consists of three main parts that fit one within the other in scraped bearings: (1) a cylindrical housing, 12⅝ in. in diameter by 11 in. high, that is fitted to a flanged universal mounting for 180 deg. swiveling, (2) an inner body that is bored eccentrically for the spindle carrier and also equipped with worm ring for rotation, and (3) the spindle carrier which is fitted with a 1-in. capacity collet.

The eccentrically bored inner body can be rotated within the housing so that the spindle carrier is at dead center or offset from center up to 7 in. swing. After each operation of rotary milling, the cutter spindle is returned to dead center, checked by means of a spindle lock and then reset for the next operation on the piece.

The worm handwheel at the top is used for setting the desired diameter while the worm handwheel at the left causes the tool to follow the desired circular path. Three lugs on top of the head can be set to disengagement when rapid spindle is required. Collars on both assemblies are graduated in degrees and minutes.

American Zinc-Plated Steel Alternates for Critical Metals

A substitute for performing the work of nickel, tin, aluminum, brass or copper as an alternate for these critical metals is the zinc-plated steel produced by American Nickeloid Co., Peru, Ill. It is made in the form of sheets up to 36×96 in. in most gages, and in a full range of tempers. It is supplied polished, unpolished, satin finish on one or both sides, and the zinc plating thickness can be varied to meet specific requirements.

This steel can be bent, stamped, formed, drawn, soldered and spot-welded, and has a smooth, uniform surface which is said to be non-cracking or non-flaking. When electroplated to a steel base, a galvanic action takes place between the zinc coating and the basic steel which imparts additional corrosion resistance to the steel.

Curran Parts Cleaning Basket Is Fitted Into Shipping Pail

Curran Corp., Malden, Mass., is making a dunking and dryer basket entirely from scrap metal. The basket kit is included with a standard 5 gal. steel shipping pail with a removable top which contains recently announced Carbon Met. The part to be cleaned is

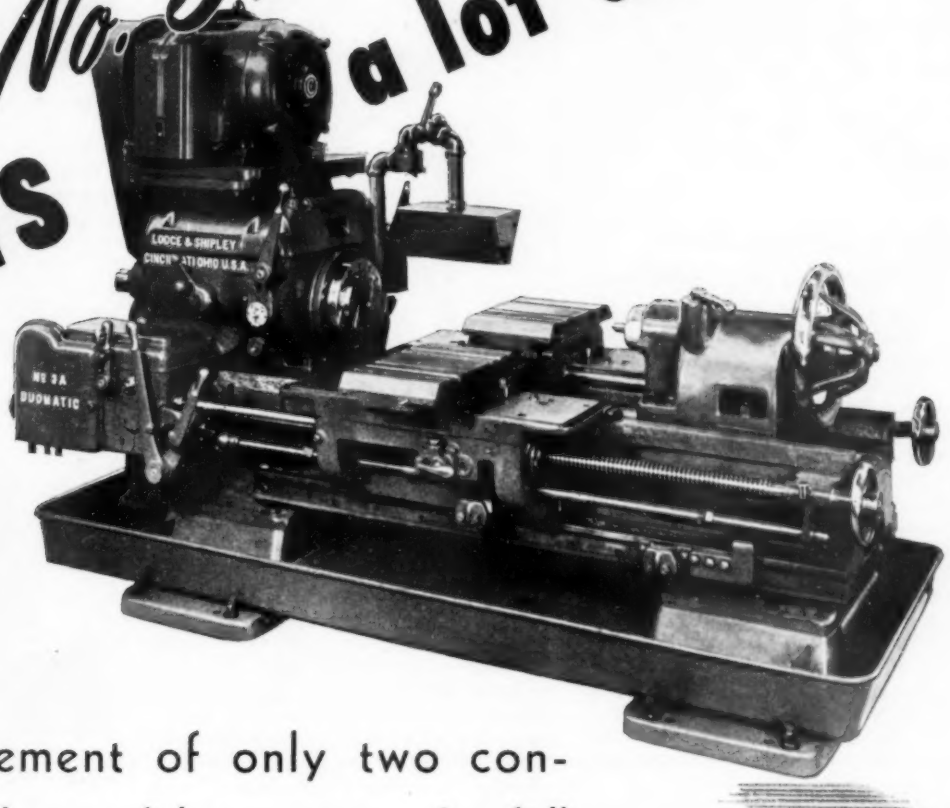
placed in the dunking basket, and on withdrawing the basket, the spring-like clips attach themselves to the edge of the container allowing excess solvent to drain back into the pail.

National Cutting Oil Series Suit Most Metal Machining

A series of metal cutting oils, recommended for use in machining practically all metals, is available from National Oil Products Co., Harrison, N. J.

Vegicut A is of the fatty mineral type, derived from a vegetable source, suited for light work on steel and for all work on brass, copper and other non-ferrous metals. The oil wets and quickly spreads on metal surfaces. This spreading action insures maximum lubrication and transfers the heat away from the cutting edge of the tool. It is a clear fluid, non-corrosive, light

The No. 3A Duomatic SAVES a lot of Hands



The movement of only two conveniently located levers puts the full automatic machining cycle in operation.

Write for fully illustrated Book No. 601-FL, completely covering the No. 3A Duomatic-Automatic Lathe.

THE LODGE & SHIPLEY MACHINE TOOL CO.
CINCINNATI, OHIO, U.S.A.
ENGINE TOOL ROOM AUTOMATIC LATHES

in color, and is said not to tarnish copper and its alloys. It is claimed to be more resistant to rancidity and oxidation than fats of animal origin.

For all cutting operations on aluminum alloys and magnesium, especially on high-speed work, Vegicut B is recommended. This is also derived from a vegetable source. It may be used for grinding operations on bronze, copper, monel and similar alloys.

Vegisol is a soluble oil for light and medium cutting of steel and non-ferrous metals. It is a brownish-black oil, which instantly disperses in water to form a stable emulsion.

For use in machining tough alloys, Vegisulph, a sulphurized fatty oil of heavy-duty quality, is recommended. It is a medium viscosity blend of a selected mineral oil, is sulphurized fatty ester and a surface-active synthetic. It acts as an anti-flux in preventing the chip from welding to the cutting tool. It is said that Vegisulf has high lubricating power and low surface tension, is non-staining at ordinary temperatures, and may be used on any types of work from automatic screw machines to heavy broaching.

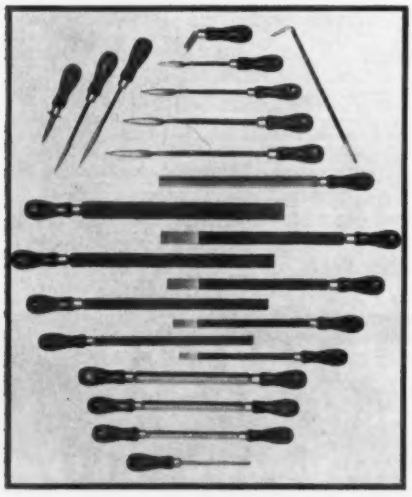
Murcott & Campbell Scrapers Available in Wide Assortment

A line of metal scrapers to meet the needs of most metal scraping operations has been introduced by Murcott & Campbell, Inc., 582 Union Ave., Brooklyn, N. Y. The flexible scraper is made in four sizes, uniform in width and tapering in thickness from shoulder to tip. They are suited for fine finishing on flat surfaces, for work on surface plates, lathe ways, milling machine tables and similar operations.

The rigid type scraper is also available in four sizes, the width and thicknesses being uniform throughout their length except at the tip or blade, which is reduced in thickness for easier sharpening and stoning. This reduction varies from 2 to 3½ in. in length, depending on the size of the tool. The rigid scraper is used for the same type of work as the flexible tool.

Gouge scrapers are curved lengthwise and hardened throughout. They are made in a 1⅛ in. blade width. They are useful in cleaning up machinery and for removing paint or grease and have the tips ground square.

Other types of scrapers available include an edge-burring, three-edge, four-edge, double-end plain and bearing scrapers. A useful accessory for finishing or burnishing the cutting edges of scrapers when extremely fine or finishing work is to be done is provided in the burnishing tool, consisting of a solid cylindrical blade 6 in. long and ⅜ in. diameter. All scrapers are furnished with polished hardwood handles. A special combination package for plant maintenance work consists of one each of ten selected scrapers.



Steber Circulite Floodlight Is Adjustable at Any Angle

The Circulite floodlight made by Steber Manufacturing Co., 2451 North Sacramento Ave., Chicago, Ill., is adjustable in a vertical range from top to bottom of the 6-ft. pipe standard at any angle horizontally, and at a 360 deg. radius. The cast-iron circular base of 20-in. diameter is portable. The 12-in. reflector is chrome plated, and either 300 or 500 watt lamps can be accommodated. Clear convex or stippled convex diffusing heat-resistant lenses are available.

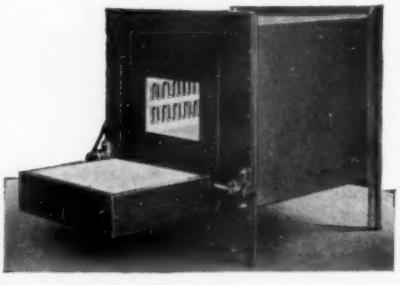
Precise-35 Electric Hand Tool Speeds Cutting of Materials

The Precise-35 high-speed electric hand tool and Coolflex flexible shaft attachment have been introduced by Precise Products Co., 1328-30 Clark St., Racine, Wis. for fast cutting on non-ferrous materials. The Precise-35 operates at 35,000 r.p.m., and is light in weight, and operates without vibration. The unit will pierce metals with speed drills up to ⅛ in. diameter, engrave glass, and write on metal and plastic. Attached to the toolpost of the lathe, this hand tool will do external or internal grinding.

The bakelite chuck cap allows the tool to be handled close to the working unit. The cap can be screwed off to accommodate the Coolflex flexible shaft attachment or to install the tool in a special stand. The housing is of plastic, and a pushbutton switch is protected against damage and accidental tripping. An overload protector

is provided which turns off the current automatically if the tool is overloaded.

The Coolflex shaft attachment is equipped with a small fan that takes in cool air through the hand-piece, and blows it over the working tool. The spindles run in two oversized sealed ball bearings which are equipped with large lubricant chambers. The Coolflex is suited for tools with shanks up to ¼ in. diameter. Mounted wheels up to 1¼ in. diameter can be easily used and the milling cutters up to ⅜ in. diameter are recommended.

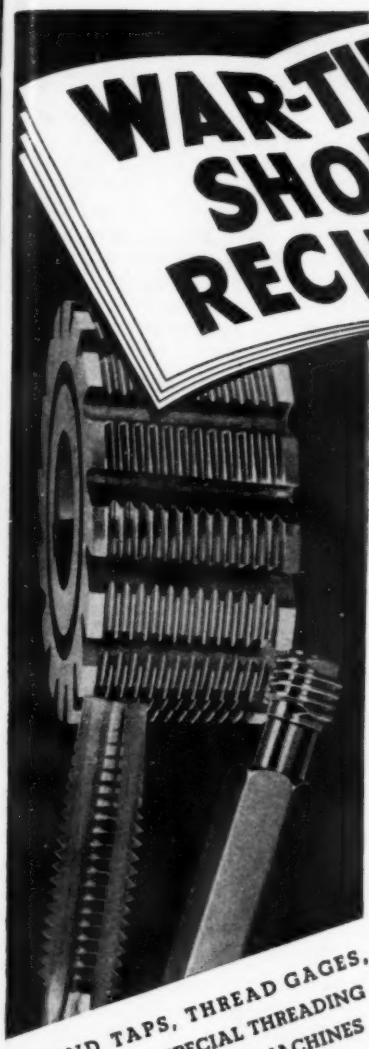


Trent Toolroom Furnace Intended for Bench Use

For hardening, annealing and heat-treating, Harold E. Trent Co., Leverington Ave., and Wilde St., Manayunk, Philadelphia, Pa., has brought out the MLR-4 bench type toolroom furnace. It is 7½ in. wide, 5½ in. high, and 14 in. deep, runs continuously at 1,850 F. and operates on 115 volts.

The outer casing is made of steel lined with layers of insulation. The welded steel door is brick lined and is the quick-acting lever-operated type. When in open position, it can be used as a loading table.

This furnace can be controlled either manually or automatically. For manual operation it is necessary to use the rheostat in conjunction with the indicating, but not controlling type pyrometer. The pyrometer indicates the temperature, and the rheostat is used



MAKE *Sharpening* EASIER

No. 4 in a series

Parts produced with this Detroit Tap and Tool combination thread milling and boring cutter were superior to those produced with competitive spiral gashed cutters.

GROUND TAPS, THREAD GAGES, THREAD HOBS & SPECIAL THREADING TOOLS. SPECIAL TAPPING MACHINES

For many years it had been the accepted practice in certain high precision thread milling operations in aircraft engines to use spiral fluted hobs. Today, as the result of a suggestion from Detroit Tap engineers, straight fluted hobs like the one above are used for this operation.

Result No. 1: Even relatively untrained women can sharpen these cutters accurately now, whereas the spiral fluted types were very difficult to sharpen.

Result No. 2: Thread accuracy is even better than with the spiral fluted hobs.

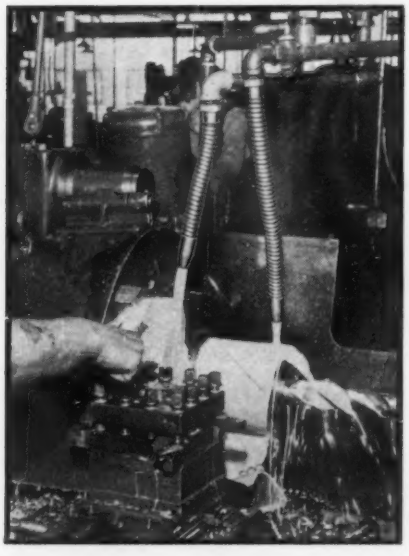
The reasons: The main purpose of spiral-fluting is to reduce impact. In internal milling with more than one set of teeth in contact at one time, spiral fluting is frequently unnecessary. Straight fluted hobs are always easier to sharpen accurately than spiral fluted types.

This is just one of the many examples of how Detroit Tap field engineers have helped to improve accuracy, simplify production, and reduce cost in threading operations. Sometimes a little change will make all the difference. They'll be glad to help you too.

DETROIT TAP & TOOL CO.

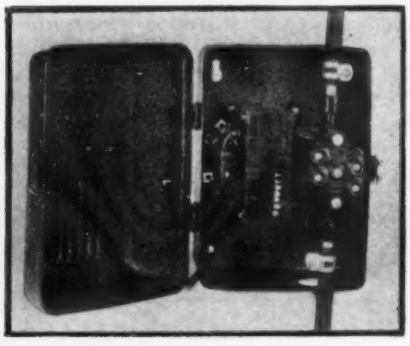
8432 BUTLER STREET, DETROIT, MICHIGAN, U. S. A.

to adjust the voltage to maintain the desired temperature. For automatic control, an indicating and controlling pyrometer is used in conjunction with a magnetic switch. The pyrometer can be set to the temperature desired, and will control the furnace automatically.



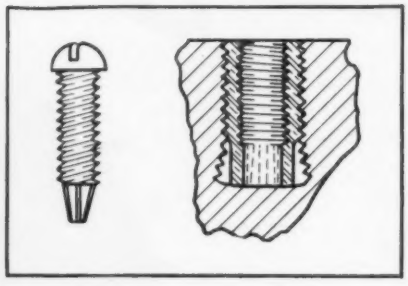
Bullseye Coolant Spout For Machine Applications

The improved Bullseye coolant spout made by J. N. Fauver Co., 49 West Hancock Ave., Detroit, Mich., is readily adjusted by finger tip pressure to any angle or curve directing the coolant stream directly on the tool. Its flexibility permits easy re-adjustment as the work progresses. It is said to be rustproof, leakproof and scale-proof, and is available in sizes ranging from ⅛ to ¾ in. inside diameter in any length. The spout is also adjustable for oil, air, water and steam.



Westinghouse Flow Switch Has Resistance Welding Use

For resistance welding and other applications, an electro-thermostatic flow switch which detects the lack of water required for adequate cooling of Ignitron tubes has been produced by Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. It consists of a 100-watt transformer having a one-turn secondary short-circuited through a piece of high resistance stainless steel tubing, through which water flows from the Ignitron tubes. A normally closed two-pole thermostatic switch is used. It is available in one ½ or three 1½ gal. per min. size, in both a 25 or 50-60 cycle, 220-440 volt rating. For supplying an auto transformer, other voltage ratings are available. The unit requires a mounting space approximately 7 in. wide by 9 in. high and 5 in. deep.



Marco Makes Mushroom Inserts Suited for Plastic and Metal

A permanent holding mushroom insert is offered by Marco Co., Wilmington, Del. A simple method of expanding the threaded insert at the bottom is accomplished by inserting a hand tool shaped to conform to the taper of the insert, or a tool of similar shape can be applied in either a trip or air gun. This causes the insert to mushroom out at the bottom forming a star-like projection that acts as a locking media. As the insert is not cut through either before or after the operation, there is no possibility of its springing back to the original shape. The insert is suited for such materials as plastics, fiber, copper, aluminum and bronze.

Koebel Diamond Dressing Tool Requires No Special Dresser

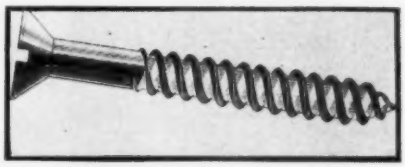
A diamond dressing tool that fits most standard machines has been developed by the Koebel Diamond Tool Co., 9456 Grinnell, Detroit, Mich. Known by the name of Kodi, this tool does away with the necessity of a special dresser for each machine.

It is supplied with a special shank fitted with a recessed head setscrew which locks the Kodi nib in position. The shank, or Ko-Adaptor, remains in the machine after installation, and only the nib is removed for resetting or replacement. An additional feature of the tool is graduations placed in a developed sequence to guide the operator.

Twin-Fast Screw for Plastic Is Shaped for Tight Holding

A twin-thread screw for plastic and combination assemblies has been introduced by Blake & Johnson Co., Waterville, Conn., and is known as the Twin-Fast screw. This screw has two parallel threads which start at opposite sides of the shank and terminate in a single centered point. It is cylindrical in contour and self-tapping. This shape gives the screw greater strength and provides for extensive contact, tighter and greater holding power.

Another advantage is the relieved shank diameter, eliminating the danger



of fractures or ruptures under pressure. The single, sharp point of the screw is formed by the meeting of the twin threads at the axial center of the screw, allowing easy starting. Twin-Fast screws are available in all standard sizes, in steel and brass, with round, flat and oval heads.

Identometer Instrument Registers Alloy Analysis

For use in identifying any ferrous alloy an Identometer has been introduced by American Tubular Elevator Co., Instrument Div., Pittsburgh, Pa., and distributed by Dravo Corp., Machinery Div., 300 Penn Ave., Pittsburgh, Pa. A known sample is affixed to one of two clamps, and the unknown specimen to the other. When the two pieces of metal are brought into contact, the lighted indicator registers on a scale whether or not the two are of the same chemical analysis. Provided with a reference specimen, it is possible by the use of

Southwark

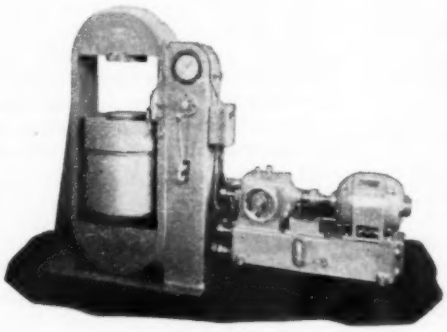
DIE-HOBBING PRESSES

Close control, smoothness in power application and rugged dependability are built-in features of Southwark hydraulic presses. These qualities are indispensable for accurate die-hobbing.

Sound design, good materials and honest workmanship are part of every Southwark press. Southwark's years of press building experience are paying real dividends in whatever industry they are used now that uninterrupted production is all-important.

When you're planning new plant equipment for the competition of tomorrow it will pay you to specify Southwark. Write for Bulletin M-160.

Baldwin Southwark Division, The Baldwin Locomotive Works, Philadelphia; Pacific Coast Representative, The Pelton Water Wheel Co., San Francisco.



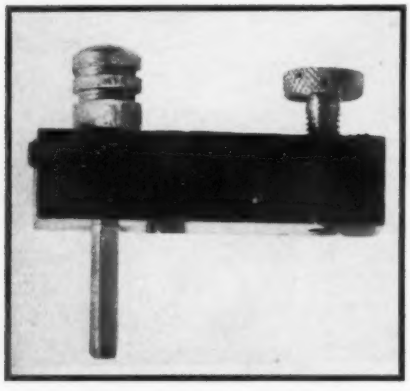
BLW THE BALDWIN GROUP **BALDWIN SOUTHWARK**

Division THE BALDWIN LOCOMOTIVE WORKS, *Philadelphia, Pa.*

the Identometer to classify unknown pieces of steel according to heats, grades, types, heat-treatments and composite types. One plug-in lead is connected to any piece in the bundle, and the other to the opposite end of the reference sample. The machine operates on the principle of thermo-electricity. The standard model operates on single phase 110 or 120 volts, 50 or 60 cycle a.c. The instrument measures 20×26×45 in. high.

Perfection Develops Process Of Silver-Finish Hardening

A silver-finish hardening process introduced by Perfection Tool & Metal Heat Treating Co., 1740-58 West Hubbard St., Chicago, Ill., provides hardening without any discoloration. This material can be applied to practically any tool steel or alloy whose hardening temperature is less than 1,900 F. and enables annealing, changes and re-hardening without any loss of surface.



"Gauge Master" for Micrometer Caliper Use Has Removable Pin

For use with a 2-in. micrometer caliper to determine depths which heretofore could only be taken with a depth micrometer, Beale & Arnold Manufacturing Co., 111-115 Glenwood Ave., Minneapolis, Minn., has developed the "Gauge Master." The device is small enough to carry in a vest pocket.

Any depth can be measured by changing pins. The gage is equipped with two pins, each having a ½-in. movement. The shoulder on the pin keeps it from jumping out of the hole where it is inserted against a spring for adjustment to the desired measurement. For deeper work, pins can be made to suit individual needs, with the use of a standard 5/32 rod.

Diamond Magnet-Block Holds Angle-Set Tool

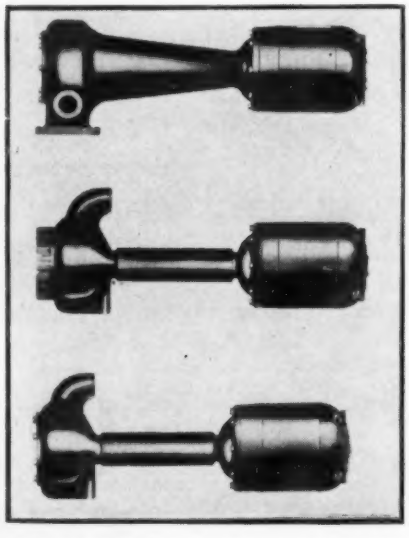
For precision grinding use in combination with the Angle-Set tool, Diamond Tool Co., 938 East 41 St., Chicago, Ill., has developed the Magnet-Block. The measurements of the block are 2½×3×1 in. and it contains a 12-deg. Angle-Set tool equipped with two lock screws.

Challenge Surface Plate Stand Available in Portable Model

A portable, all-steel surface-plate stand has been developed by Challenge Machinery Co., Grand Haven, Mich. Equipped with wheels, the stand is available in three standard sizes to accommodate 18×24, 24×24, and 24×36 in. Challenge surface plates. The stand may also be obtained without wheels in stationary models.

Pioneer Offers Coolant Pumps In Three Models and Many Sizes

Three coolant pumps, each available in seventeen standard sizes, are offered by Pioneer Pump & Manufacturing Co., Detroit, Mich. Model VBD has three outlets to permit piping on either right or left side, or back into the coolant sump through the intake bracket. The

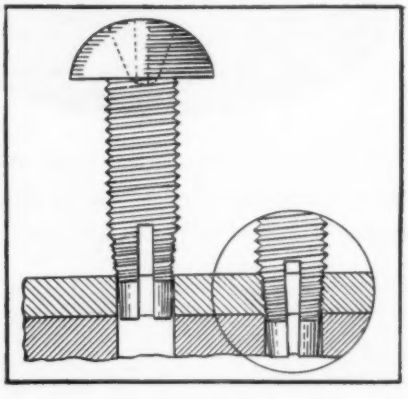


Model VA is used where submersion in the coolant sump is more practical than the outside mounting, while the Model VC has been designed for external use in cases where a tank cannot be mounted with a vertical or horizontal bracket.

Harnischfeger Makes Heavy and Intermittent Duty Arc Welders

Harnischfeger Corp., Milwaukee, Wis., has extended its line of P&H arc welders by introduction of seven heavy-duty a.c. models and four intermittent duty models. This new line features the recently adopted welding service range ratings which show the actual minimum to maximum output of usable welding current.

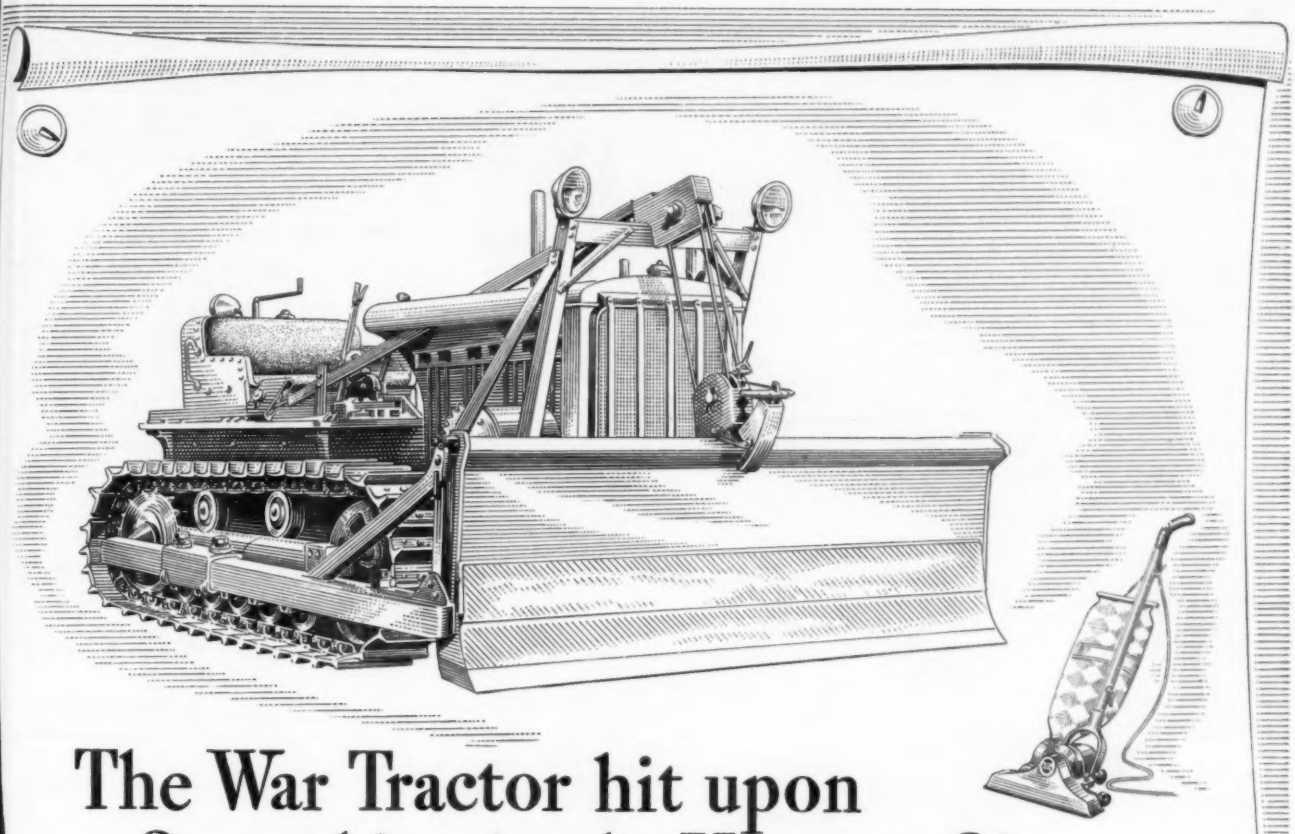
Ranges of capacity for the heavy-duty model are from 50 up to 1,200 amp., while for the intermittent model, service range is from 20 to 335 amp. A simple, easily operated adjustment is provided for setting and control of the current throughout the complete welding service range.



Continental Slotted Tap Screw Produces Self-Cutting Edge

A tap screw which cuts threads accurately in correct alignment as it is driven into metals or plastics, has been developed by Continental Screw Co., New Bedford, Mass. A slotted opening is provided at the entering end of the screw which produces a self-cutting edge that closely simulates the cutting action of a tap.

An additional advantage of the slot is the spring or yield when the screw is fitted in the hole and during the self-threading action. This spring enables a screw to be more accurately



The War Tractor hit upon Something in the Vacuum Cleaner

ON THE FACE OF IT, a vacuum cleaner and a military tractor live in different worlds. The cleaner's job is a light-duty one—and what matters most is easy operation. That's why Torrington Needle Bearings were chosen for use in this household machine. With its low friction coefficient and compact design, the Needle Bearing is one of the reasons modern vacuum cleaners can be as easy to handle as a new broom.

The men who drive the tractors, on the other hand, are concerned chiefly with their ability to stand up under the most severe service conditions. But when a new bomber runway is wanted by dawn, or shell holes must be repaired while bombs are still falling, it helps to have a tractor whose mechanism responds quickly and smoothly. So tractor designers, too, turned to the Needle Bearing for long life and ease of operation... and found many other advantages as well. It seldom needs attention, thanks to an effective system of lubrication... it withstands overloading more easily, because of high load capacity... and it speeds tractor production, through its ease of installation and ready availability for essential applications.

SOMETHING TO KEEP IN MIND FOR POST-WAR. You'll soon be planning your post-war designs—or perhaps you've already started. There may be an idea for you in the Torrington Needle Bearing. Its advantages are the very features Tomorrow's customers are being educated to want—longer life, faster speeds, greater ease of operation, more compact designs, less need of attention. Whatever your design problems, let Torrington engineers help you. They are expert in adapting the Needle Bearing to specific applications. A long list of *typical* uses is included in Catalog No. 105.

NEEDLE BEARINGS FOR ALL PURPOSES

LOOSE ROLLERS are produced in a range of sizes for assembly into low-cost, high-capacity anti-friction bearing units. They are particularly adaptable to applications where volume permits installation of the necessary equipment.

NEEDLE BEARINGS are complete, self-contained units consisting of a full complement of rollers and a thin, hardened outer race. They offer the advantages of small size, low cost, high capacity—and are easily, quickly installed.

QUILL BEARINGS consist of a full complement of rollers and a relatively heavy hardened outer race. They are furnished with or without inner races. Quill Bearings are adaptable to heavier load requirements than Needle Bearings.

THE TORRINGTON COMPANY

Established 1866 • Torrington, Connecticut, U. S. A.

Makers of Needle Bearings and Needle Bearing Rollers

New York Boston Philadelphia
Detroit Cleveland Seattle
South Bend San Francisco Chicago
Los Angeles Toronto London, England

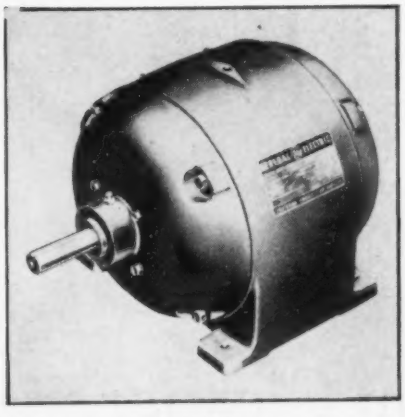
TORRINGTON NEEDLE BEARINGS

driven into openings of varying diameters, thus providing self-adjustment by exerting a yielding pressure during the cutting operation. The hardened thread-forming screw is furnished with slotted head or Holtite Phillips head.

G. E. Makes Tri-Clad Motors That Are Totally Inclosed

For use where abrasives, chemicals and excessive dirt are encountered, General Electric Co., Schenectady, N. Y., has developed a line of totally inclosed motors available in both the polyphase, induction type and the single-phase, 60-cycle, capacitator type.

The polyphase motors are furnished in frame sizes 203 to 225. They include



½, ¾ and 1 hp. at 900 r.p.m.; ¾, 1 and 1½ hp. at 1,200 r.p.m.; 1, 1½ and 2 hp. at 1,800 r.p.m.; and 1½ and 2 hp. at 3,600 r.p.m.

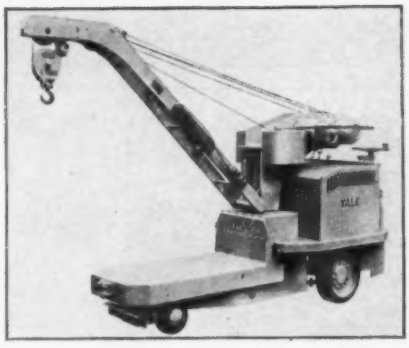
The single-phase motors are furnished in frame sizes 203 and 204, and include ¾ hp. at 1,200 r.p.m.; 1 and 1½ hp. at 1,800 r.p.m.; and 1½ and 2 hp. at 3,600 r.p.m. The mounting dimensions of these motors are interchangeable with Tri-Clad open motors of the same rating.

All parts of the motor inclosures are cast iron and thus offer resistance to rust, corrosion, accidental blows and rough use. The leads are permanently encased in compound in a cast-in pocket in the stator frame, preventing liquids from seeping into the motor. Further protection is provided in the form of a rotating labyrinth seal, which prevents oil, dirt or water from entering the bearing housing.

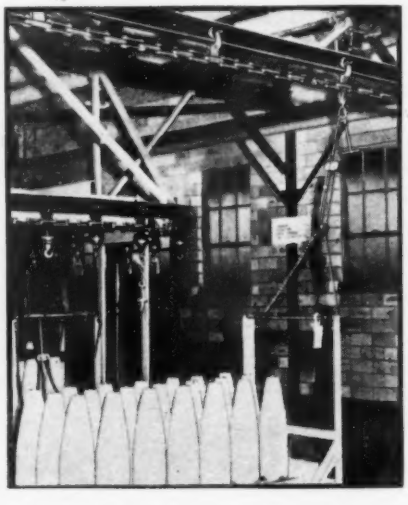
Yale & Towne Twin Unit Combines Truck and Crane

A twin unit crane has been introduced by Yale & Towne Manufacturing Co., 4530 Tacony St., Philadelphia, Pa., known as the Model K23E-6C2T. It combines a 6,000-lb. capacity low elevating platform truck and a 2,000-lb. capacity twin unit crane. It is electrically operated with four speeds forward and reverse, and is designed for maximum maneuverability in close quarters and greater visibility.

A Cable King winch unit supplies the hoisting and booming power, and



both can be operated simultaneously through separate pushbutton type crane and hoist controls. Separate, independent motors and power unit drive the truck for travel as well as hoist and boom the load. In addition, slewing is conveniently controlled by hand. The over-all length of the chassis with platform raised is 127 in., and over-all height with the crane boom lowered is 67 in., and its width is 44½ in.



Alvey-Ferguson Conveyor Unit Is Built for Towing Trucks

The truck towing conveyor installation brought out by the Alvey-Ferguson Co., 71 Disney St., Cincinnati, Ohio, is built to tow trucks loaded with any type of commodity through sub-assembly and final assembly. The towing hooks are easily detached by hand or automatically at any predetermined location where parts carried are processed or assembled.

The equipment illustrated is equipped with swivel hooks used for conveying parts through automatic spray painting machines and drying ovens. The rotating pulley is so constructed that the parts are mechanically turned during the painting process.

Alkacite Brush-On Liquid Protects Against Corrosion

Alkacite, Type A, introduced by Protective Coatings, Incorporated, P. O. Box 56, Strathmoor Station, Detroit, Mich., is a brush-on liquid for general industrial service for metals, wood and concrete among various uses. It offers protection against corrosion and is widely used for tank coatings and for lining water and mild acid tanks. The product is basically a mineral resin. It withstood a test in 25 percent nitric acid solution maintained at 200 F.

Careystone Flat Sheathing Makes Fireproof Lockers

Careystone flat sheathing, made by the Philip Carey Manufacturing Co., Asbestos-Cement Products Dept., Lockland, Cincinnati, Ohio, is suited for building lockers. The material is produced from combining selected cement and asbestos fibers under severe pressure, resulting in a stone-like substance which will not rust or corrode, as well as being fireproof. This sheathing is available in sheets 48×96 in., and ⅜ in. thick. It can be easily put together by maintenance men.

TRADE PUBLICATIONS

AIRCRAFT CHAINS The Aircraft Chain Division of Link-Belt Co., 220 South Belmont Ave., Indianapolis, Ind., offers aircraft engineers 36-page loose-leaf engineering data book No. 1825 which contains information needed when designing chains and sprockets into aircraft applications.

AUTOMATIC BUCKERS The Aero Tool Co., Burbank, Calif., has issued a folder which illustrates and describes the portable automatic bucker which bucks and rivets in one operation and is used by one operator.

BANDSAW A bulletin describing their metal cut-off bandsaw is obtainable from the Johnson Mfg. Corp., Albion, Mich. Important features, outstanding advantages and general specifications are given.

BRAZING ALLOYS Bulletin No. 12-A, an 18-page revised edition of their general catalog on Sil-Fos and Easy-Flo brazing alloys has been prepared by Handy & Harman, 82 Fulton St., New York, N. Y.

BUSHING Bulletin No. 237, a specification folder dealing with the "Heli-Coil" spark plug bushing, a variation of the "Aero-Thread" system, has been prepared by Aircraft Screw Products Co., Inc., 47-23 35 St. Long Island City, N. Y.

COMPRESSOR Photographs, specifications, dimensions and weights of the Model No. 20 compressor are presented in the folder prepared by Schramm Inc., West Chester, Pa.

CONVEYORS The 6-page folder of The Alvey-Ferguson Co., 71 Disney

St., Cincinnati, Ohio, contains illustrations and descriptions of conveyors designed for more efficient indoor transportation.

CUTTING TOOLS Third pamphlet in a series based on the slogan, "Tool Conservation Begins in the Tool Crib," published by Greenfield Tap and Die Corp., Greenfield, Mass., "22 Reasons Why a Good Tap Can go Wrong" has just been made available to distributors.

DERMATOSIS Industrial dermatosis and preventitive products are described in non-technical terms in a brochure of the West Disinfecting Co., 42-16 West St., Long Island City, N. Y.

DIAL INDICATORS A folder describing and pricing the "Testmaster" line of dial indicators produced by the Federal Products Corp., 1144 Eddy St., Providence, R. I., has been issued by that company.

DIE CASTING The purpose of the booklet "Zinc Alloy Die Casting," published by The New Jersey Zinc Co., 160 Front St., New York, N. Y., is to answer questions most frequently asked about these castings.

DIES A new 32-page cemented carbide die manual and catalog, covering standard and special dies for drawing wire, bar, tubing and sheet metal has been made available by Carboloy Co., Detroit, Mich.

DIE STEEL "Cromoco Air-Hardening Die Steel for High Production," is the title of a leaflet published by Firth-Sterling Steel Co., McKeesport, Pa. Presented therein are compositions, characteristics, general and special applications and other information concerning Cromoco.

FINISHING Degreasing, descaling and derusting methods used in preparing ferrous and non-ferrous metals for black oxide finishes are described in the 20-page booklet issued by Oakite Products, Inc., 24 Thames St., New York, N. Y.

FLEXIBLE JOINTS Hinged and universal joints produced by Brooks Equipment Corp., 90 West St., New York, N. Y., are pictured and described, along with specifications and blueprints of typical applications, in a book just published by that firm.

FLEXIBLE METALLIC TUBING Titeflex Metal Hose Co., 500 Frelinghuysen Ave., Newark, N. J., has released their catalog No. 113, which deals with the general industrial applications of the line of flexible metallic tubing.

FORMING The use of the "'Standard' Hydro-Former" in shaping and joining metals without cutting is described in a pamphlet available from the Standard Machinery Co., Providence, R. I.

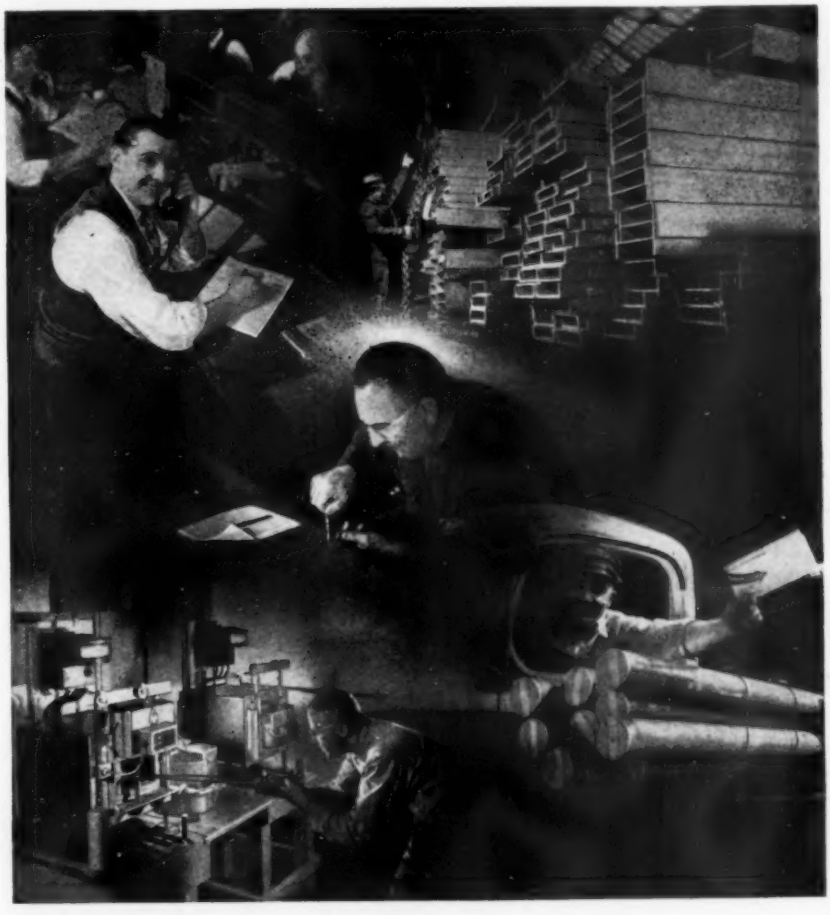
More Steel Available At Local Warehouses

Not long ago the War Production Board assigned special tonnages of steel for warehouse stocks. Now, these steels have been rolled and are arriving in quantity at local warehouses for distribution.

For some time certain war production has suffered for lack of small amounts of critical steels usually obtainable at warehouses. It is intended that these needs be met immediately and that there be ample reserves to meet future emergency requirements.

Among the first to announce the improved stock situation is Joseph T. Ryerson & Son, Inc., the nation's largest steel-service organization. At their ten plants they report a marked improvement in all but a few stock items. Attention is called to the complete stock of structural steels available for immediate shipment.

Engineers and metallurgists at Ryerson have maintained an enviable reputation for taking care of customers' requirements, in spite of difficulties. The war production effort has been greatly aided by Ryerson services to industry and to the nation.



Many Skills Combine in Ryerson Steelmanship

• Many skills and complete modern equipment for testing, cutting, forming, handling, shipping—all combine in Ryerson *Steelmanship.* All are devoted to the single purpose of this vast highly specialized steel warehouse system. All contribute to the job of getting the steel you want—in the quality, form, size and place—exactly when you want it. • True, there are our war problems of shortage here and there, but most generally Ryerson Steel-Servicemen can take care of you. • Whether it is a question of selection, fabrication or just quick delivery—*call Ryerson first.*

JOSEPH T. RYERSON & SON, INC. • Chicago • Milwaukee • St. Louis • Detroit Cincinnati • Cleveland • Buffalo • Boston • Philadelphia • Jersey City

RYERSON STEEL-SERVICE

★ FOR THOSE WHO WANT THE FINEST ★

ELLSTROM

★

Originators OF CHROMIUM PLATED • GAGE BLOCKS •

DEARBORN GAGE CO. • • DEARBORN, MICH.

THE WORLD'S STANDARDS

★ THREE GENERATIONS OF GAGE MAKERS ★

FORMING Descriptive material of the general line of high production metal forming machinery engineered and manufactured by The Yoder Co., 5500 Walworth Ave., Cleveland, Ohio, appear in a newly published general bulletin.

HOBS A bulletin describing their line of small fine pitch hobs has been released by Barber-Colman Co., Rockford, Ill. Hobs ranging from 30 to 200 D.P. are detailed and uses described and pictured.

HOLDING DEVICES A bulletin issued by the Michigan Clamp Co., Jackson, Mich., describes "Twistite" push-pull pressure units, C-clamps and holding devices of special design into which "Twistite" units can be built.

HONING Bulletin No. 121-H of the Barnes Drill Co., 814-830 Chestnut St., Rockford, Ill., describes the "Barnesdril" honing process and self-oiling hydraulic vertical and horizontal honing machines.

HYDRAULIC DUPLICATING The Turchan Follower Machine Co., 8259 Livernois Ave., Detroit, Mich., has issued a booklet illustrating and describing hydraulic duplicating equipment capable of being attached to any standard type lathe, planer, shaper, grinder or milling machine.

INSULATION The Sterling Varnish Co., 105 Ohio River Blvd., Haysville, Pa., has issued Bulletin 143, describing thermobonds insulation, for high-speed armatures, high cycle drill and grinder motors, etc.

LATHES The South Bend Lathe Works, South Bend, Ind., has issued catalog No. 14-C, containing full information on that company's 14½-in. toolroom and engine precision lathes. Attachments and accessories and tools for use with these lathes are also listed, and a portion of the catalog is devoted to construction features.

LATHES Bulletin H4, "Keep Your Lathe in Trim," a 28-page booklet containing information on lathe maintenance, test and adjustments, helpful to lathe operators, service men and millwrights, is available from South Bend Lathe Works, South Bend, Ind.

LATHE TURRETS Five station oscillating tool block lathe turrets, along with tool holders and other accessories, are described and priced in a catalog of the Automatic Machine and Tool Co., 132 Charles St., Auburndale, Mass.

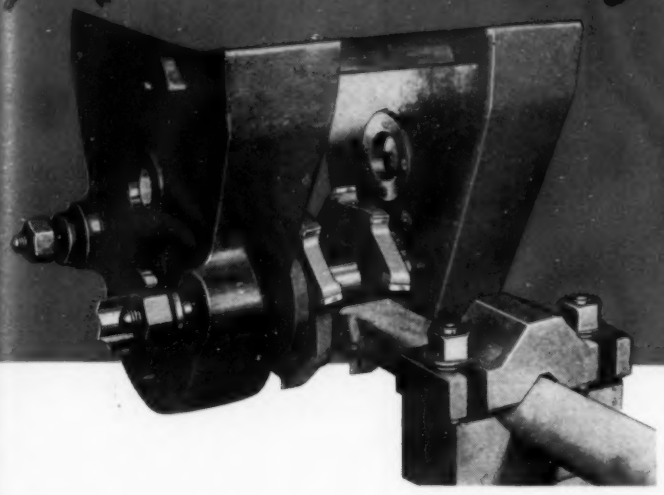
LIGHTING To introduce their new all-purpose line of fluorescent fixtures for war industries, the Mitchell Mfg. Co., 2525 N. Clybourn Ave., Chicago, Ill., has published a comprehensive 8-page, two-color catalog.

LIGHTING The 12-page catalog, No. 101, of Reliance Devices Co., Inc., 510

*FIRST IN A SERIES

Kennamilling

The Pioneer Process of Face Milling Steel With Cemented Carbides



The illustration shows two GRAYSON-KENNAMETAL 6" Half-Side Mills, with negative cutting angles, which milled heat-treated 4130 steel at a feed of 19¾".

KENNAMILLING, sometimes referred to as "Hyper-milling" or "Super-milling", was in three-shift operation in the McKenna Metals Company plant as early as April, 1940.

Devised by McKenna engineers, KENNAMILLING has been used for three years by KENNAMETAL customers also, to obtain greatest steel-cutting production on their face milling operations.

Because of the inherent hardness and strength of KENNAMETAL steel-cutting carbide, KENNAMILLING has maintained its leading position despite the entrance of similar processes into the field of face milling with cemented carbides.

The characteristic strength and hardness of KENNAMETAL have been combined with the shock resistant well designed Meehanite bodies of GRAYSON milling cutters to form the most efficient milling cutter available, the GRAYSON - KENNAMETAL milling cutter. Through use of these cutters production is being tripled on operations which demand milling of steel, cast iron, aluminum, aluminum-silicon alloys, magnesium -aluminum alloys, brass, bronze, and non-ferrous materials.

KENNAMILLING With GRAYSON-KENNAMETAL MILLING CUTTERS, HAS THESE ADVANTAGES:

1. GRAYSON-KENNAMETAL milling cutters cut steel at amazingly high speeds.
2. KENNAMILLING is distinguished by greater table feeds and greater load per tooth. (Instead of the customary .001 to .003 the load per tooth during KENNAMILLING is .003 to .016)
3. KENNAMILLING employs negative rake and negative helix angles for maximum cutting efficiency.
4. These double negative rake angles—added to KENNAMETAL'S non-galling properties, hardness, and rupture strength—permit the milling of high Brinell steels.
5. These double negative rake angles also produce a very rugged tool—milling machines have been stopped in the cut without chipping the edges of end mills.
6. KENNAMILLING produces a precision finish.
7. KENNAMILLING is not limited to light cuts.

Write for complete information about KENNAMILLING . . . McKenna Metals Company can give you assistance based on years of face milling production with cemented carbides.

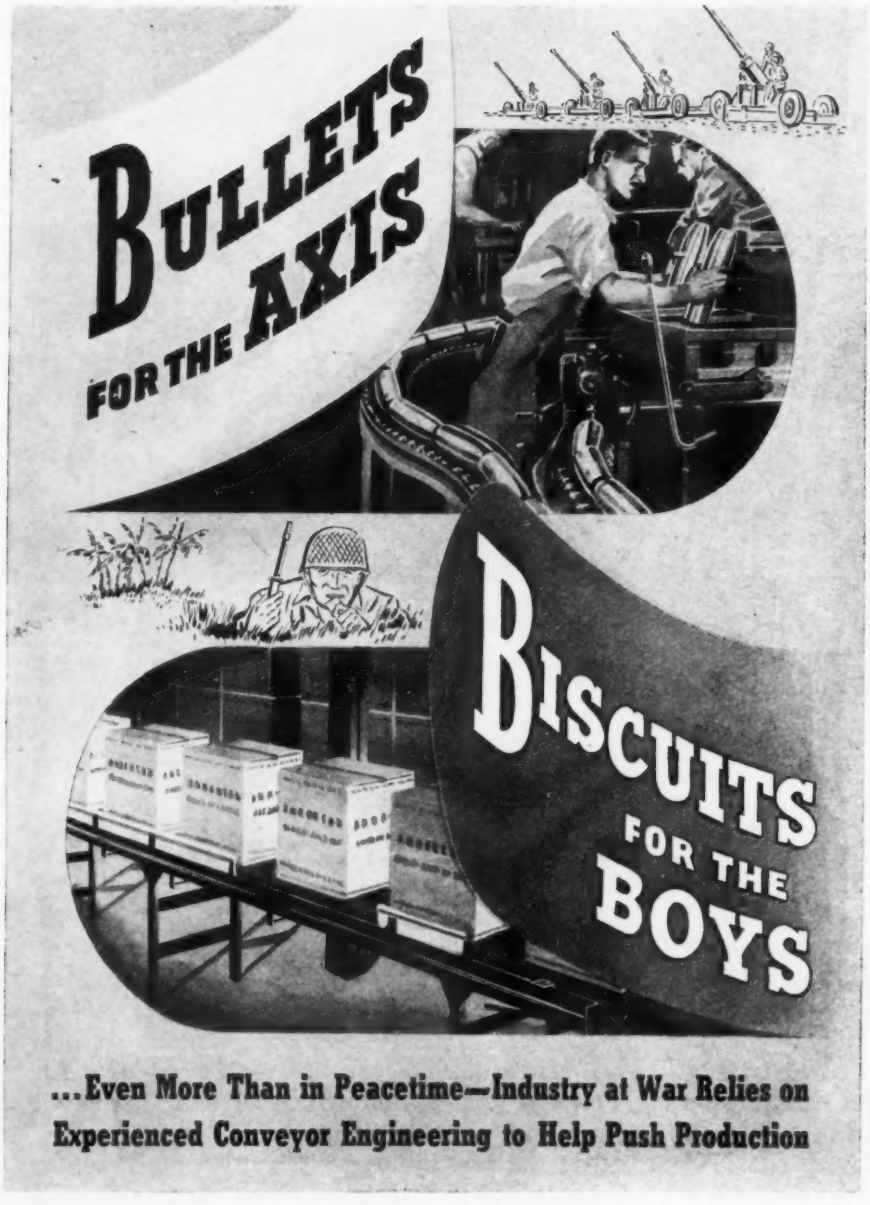
McKENNA METALS Co.

103 LLOYD AVE., LATROBE, PA.

Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York (Exclusive of Canada and Great Britain)

Trade Mark Reg. U. S. Pat. Off.

KENNAMETAL THE All American CARBIDE



...Even More Than in Peacetime—Industry at War Relies on Experienced Conveyor Engineering to Help Push Production

Munitions — arms — equipment — food — prime products of industry geared for war.

In many war plants specially designed and built Standard power and gravity conveyors — shell conveyors, for example — are doing their part to maintain peak production. In essential industries, such as food products plants — process industries — Standard Conveyors are in greater use than ever — keeping production flowing. An extensive and varied experience record qualifies Standard Conveyor Company to render valuable aid and counsel to production and plant executives. Tell us what you handle — how much — how far — our recommendations will prove worth while.

A valuable reference book, "Conveyors by Standard" Catalog AM-6 will be included in response to your inquiry.

STANDARD CONVEYOR COMPANY

General Offices: NORTH ST., ST. PAUL, MINN.

Sales and Service in All Principal Cities

★ ENGINEERED FOR FASTER PRODUCTION ★

Sixth Ave., New York, N. Y., pictures various types of Swivelier sockets and directive lighting units and some of their applications. Catalog No. 102 covers "Swivelier" Work-Lites.

LIGNUM-VITAE A "Wartime Report on Lignum-Vitae," describing the diversified applications of this natural, self-lubricating, tropical wood, has been published by Lignum-Vitae Products Corp., 96-100 Boyd Ave., Jersey City, N. J.

LUBRICATION The progress in the development of lubricating oils is presented, and the place these products have played in aiding the war effort is set forth in a booklet issued by Swan-Finch Oil Corp., R.C.A. Building, West, New York, N. Y.

MACHINE TOOLS The Austin-Hastings Co., Inc., 226 Binney St., Cambridge, Mass., has prepared a catalog on machine tools and metal working equipment.

MAGNESIUM To consolidate and present essential facts on production and refining of magnesium, Fisher Furnace Co., 5535 N. Wolcott Ave., Chicago, Ill., has published the "Magnesium Scrapbook," which includes information relative to furnaces, fuels, melting, fluxing, inhibitors and fire prevention.

MAINTENANCE Bulletin No. PE-1943, issued by the Owatonna Tool Co., 353 Cedar St., Owatonna, Minn., explains and illustrates methods for removing and replacing gears, bearings, pulleys, sheaves, wheels and other closely fitted parts.

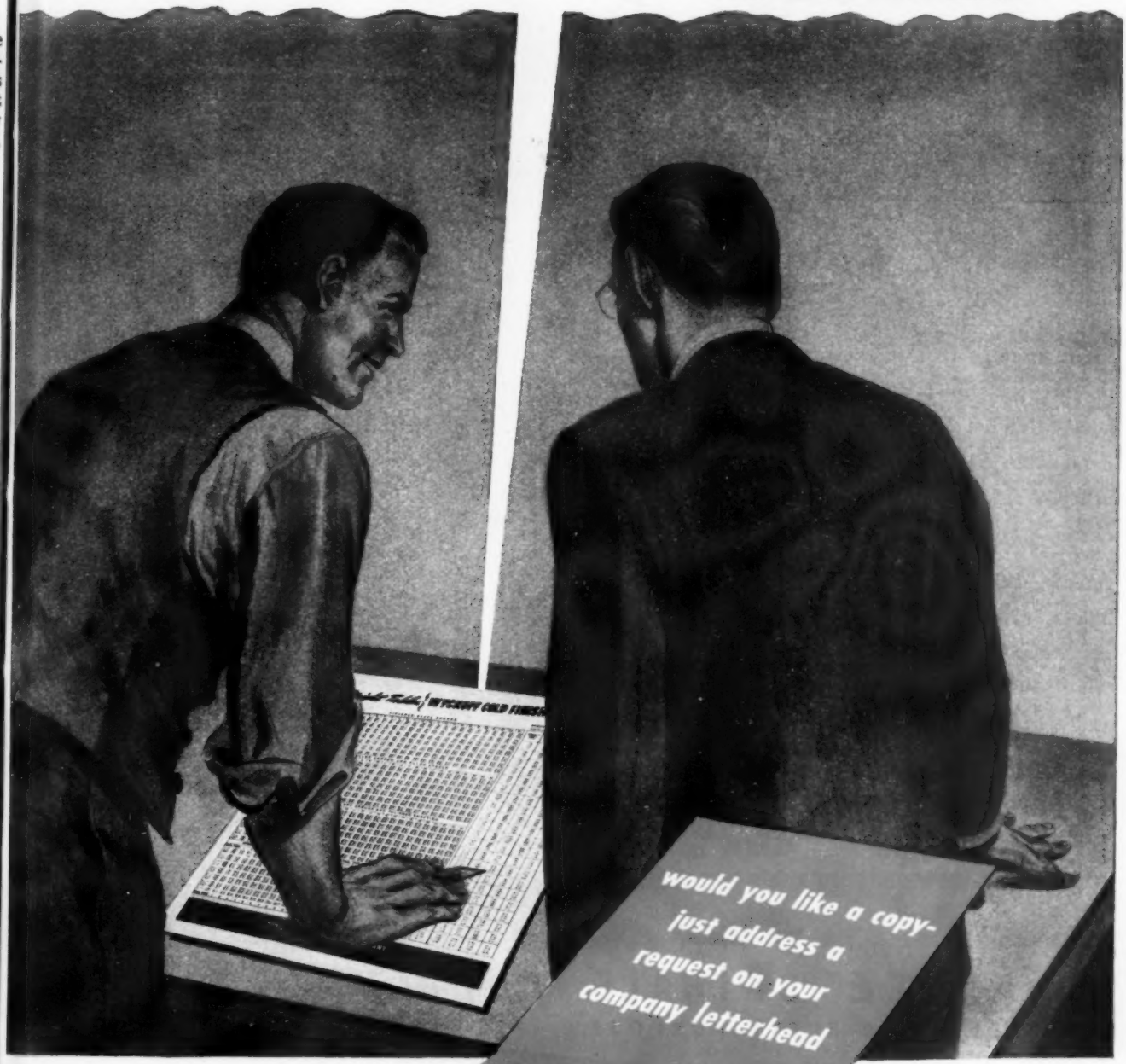
MANPOWER Parish & Phillips, classified advertising counselors, Daily News Tower, Miami, Fla., announce the publication of the "Employment Advertising Encyclopedia," containing helps in writing productive help wanted advertising. It is priced at $1 a copy.

METAL CLEANING A new bulletin, Form No. 11543-1 SUP, describing the uses of the four available types of cyclodiene base hydrocarbon solvent degreasers and cleaners for metals, is offered by the Technical Processes Division, Colonial Alloys Co., Colonial Philadelphia Bldg., Philadelphia, Pa.

METAL-WORKING FACILITIES The Ward Products Corp., 1523 East 45 St., Cleveland, Ohio, has issued a 24-page illustrated brochure outlining in detail the production facilities and equipment available in its two plants for handling contract work from other manufacturers.

MOTOR CONTROL Mot-O-Trol, an electronic adjustable-speed drive which provides wide stepless range, automatic speed regulation and smooth fast acceleration with automatic limitation is described in a new booklet announced by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

many users of cold finished steels are finding this new **Wyckoff weight chart** *invaluable*



WYCKOFF DRAWN STEEL CO.

FIRST NATIONAL BANK BUILDING, PITTSBURGH, PA.
3200 SOUTH KEDZIE AVENUE, CHICAGO, ILLINOIS

Speed is their middle name. Like an arrow in flight, they go true to the mark in straight-line production. Spiral Screw Drivers. Automatic Drills. Ratchet Bit Braces. Tap Wrenches. Quick-detachable Vises with swivel bases. These and other "Yankee" Fine Mechanics' Tools get things done . . . with speed and precision.

Speed is inherent in the very *design* of "Yankee" Tools, which for almost a half century have contributed to the efficiency and reputation of American production . . . a priceless asset in a war where *time* is the greatest shortage of all. Be sure to provide priority ratings whenever possible. Order through your supply house or write to us . . . c/o Dept. AM-6.

"YANKEE" SPIRALS
A SIZE FOR EVERY PURPOSE

★ SIMPLE
★ COMPACT
★ STRONG

"YANKEE" TOOLS
make good mechanics better
North Bros. Mfg. Co., Phila., Pa., U. S. A.
Established 1880

NITRIDING FURNACES The Nitralloy Corporation, 230 Park Ave., New York, N. Y., has published an illustrated 99-page booklet describing and illustrating nitriding and nitriding furnaces, ammonia and its handling, determination of furnace size for nitriding and instruments for measuring ammonia flow.

NUTRITION "Manual of Industrial Nutrition," a booklet just released by the Nutrition in Industry Division, War Food Administration, U. S. Department of Agriculture, Washington, is aimed toward presenting more food value in plant cafeterias and restaurants.

PANELBOARDS Square D. Company, 6060 Rivard St., Detroit, Mich., has revised its Bulletin 2500 covering Saflex power distributing panelboards.

PLASTICS The molding of tough, elastic articles with rubber-like properties from plasticized polyvinyl alcohol is described in a new bulletin, "Molding Polyvinyl Alcohol," issued by the Electro-Chemical Department of the E. I. du Pont de Nemours & Co., Wilmington, Del.

PLATING AND POLISHING Catalog No. 5 of the Chas. F. L'Hommedieu & Sons Co., 4521 Ogden Ave., Chicago, Ill., pictures and describes machines, equipment and supplies for plating and polishing."

PRECISION WORK Ace Manufacturing Corp., Erie Ave. at "K" St., Philadelphia, Pa., has just published a booklet describing in detail their precision grinding, production machining, metal stamping, heat-treating and tool and die work. Requests should be on company letterhead.

PUMPS American Automatic Typewriter Co., 614 N. Carpenter St., Chicago, Ill., has issued Bulletin 10, describing its new bellows-type vacuum pumps, for laboratory and production applications. Construction features and specifications are given.

RELAYS Folder No. 800, prepared by The R. W. Cramer Co., describes, gives pictures and prices of that firm's type TDC time delay relays.

SAFETY Information and suggestions on the care and maintenance of such safety devices as respirators, goggles, face and eye shields, welding helmets, rubber gloves, etc., are included in a new 5-page special service report issued by Oakite Products, Inc., 22 Thames St., New York, N. Y.

SCREW MACHINES The George Gorton Machine Co., Racine, Wis., has prepared bulletin No. 1800-A describing its 16-A precision automatic screw machine with attachments and specifications.

SHEAVES The Worthington Pump and Machinery Corp., Harrison, N. J.,

YOUR POSTWAR PLANNING

AND VICKERS HYDROMOTIVE CONTROLS

While postwar plans cannot now be precisely determined, it is clear that one need is for improved products to keep manufacturing at a high level and provide the work necessary to maintain the American standard of living.

After the war, business must be won against stiff competition in practically every field. Present models of many machines will be made obsolete by others with important improvements that cannot be ignored.

The exceptional versatility of Vickers Hydromotive Controls provides unusual opportunities to the machine designer . . . opportunities for far-reaching improvement in the important fields of better control—higher production rates—wider utility—greater safety—elimination of operational difficulties.

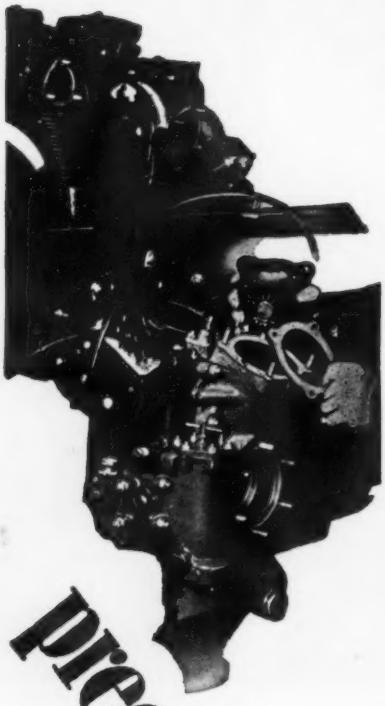
Your postwar planning is undoubtedly now underway. Vickers Application Engineers will welcome opportunities to cooperate with you.

VICKERS *Incorporated* • 1454 OAKMAN BLVD. • DETROIT, MICHIGAN

Application Engineering Offices: CHICAGO • CLEVELAND • DETROIT • LOS ANGELES • NEWARK • ROCKFORD • TULSA • WORCESTER

Representative of More than 5,000 Standardized Vickers Units for Every Hydraulic Power and Control Function

CONSTANT DELIVERY PUMPS | CONTROL ASSEMBLIES | FLUID MOTORS | VARIABLE DELIVERY PUMPS | DIRECTIONAL CONTROLS | PRESSURE CONTROLS | VOLUME CONTROLS

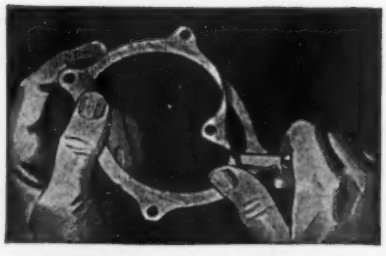


precision . . . quick

In close-precision aircraft adjustments . . . *quick* accuracy is insured by Laminum shims. From factory assembly to vital field servicing! Laminum shims (easily peeled precision brass laminations) are cut to your specifications.

Stock shim materials obtainable from mill supply dealers. (Write us for shim application folder and Laminum sample.)

Laminated Shim Company, Inc.
50 Union St., Glenbrook, Conn.



it's
LAMINUM
THE SOLID SHIM THAT PEELS FOR ADJUSTMENT

has published a file-size bulletin describing its "QD" (quick detachable) sheaves for driver and driven units, and giving various tables of pertinent statistics.

SPRINGS Mid-West Spring Mfg. Co., 4262 S. Western Ave., Chicago, Ill., has published a 4×9-in. manual presenting formulas of spring design and engineering, with illustrations, diagrams and tables.

STANDARDS The American Standards Association, 29 West 30 St., New York, N. Y., has published its new List of American Standards which will serve as a useful reference piece to the engineering and purchasing departments of manufacturing firms.

TEMPERATURE CONTROL Wheelco Instrument Co. Harrison and Peoria Sts., Chicago, Ill., has issued a condensed catalog providing a listing of the principal items of temperature control equipment manufactured by that company. Descriptions and prices are given.

TRAINING To guide the training of student apprentices, the B. F. Goodrich Co., Akron, Ohio, has published a manual outlining the various courses of study conducted and giving other pertinent information in detail. Executives of companies or organizations having, or contemplating, similar training programs, may secure free copies.

TRAINING FILM Complete information on securing two apprentice training films, "The Metal Working Lathe" and "Plain Turning," is contained in a circular, No. 8-A, issued by the South Bend Lathe Works, South Bend, Ind.

TRANSFORMERS A bulletin issued by Acme Electric & Mfg. Co., Cuba, New York, outlines and gives examples of air cooled transformer applications in war production industry, and describes in detail the various types of air cooled transformers manufactured by that firm.

TUBE SPINNING A concise story of the new process of tube spinning, recently developed by the Wolverine Tube Division of the Calumet & Hecla Consolidated Copper Co., Detroit, Mich., is told in a brochure just released by the manufacturer.

WELDING Type WD, direct-current, single-operator arc welders are discussed in a new 12-page bulletin, GEA-1440J, recently issued by the General Electric Co., Schenectady, N. Y.

WELDING As a helpful step in instructing users of the oxyacetylene welding and cutting process how to prolong the life of their equipment, the International Acetylene Association, 30 East 42 St., New York, N. Y., has prepared a 20-page, pocket size "Handbook for the Welding and Cutting Operator."

Recovery of Paint Overspray

BY S. DONALD PERLMAN,
Chief Chemical Resources Section Industrial Salvage Branch War Production Board

Approximately 50 million pounds of paint ingredients can be saved during 1943 through cooperation of paint manufacturers and consumers, according to a nation-wide survey made by the Industrial Salvage Branch, WPB.

Satisfactory methods of reclaiming overspray collected from mass-painting operations, to yield a product equal to the virgin material, have been developed. In the few years since perfection of these methods, nearly 3 million gallons have been reclaimed.

Intelligent cooperation on the part of the consumer is a prerequisite to successful reclamation. The personnel of the finishing department must be educated to regard the overspray as a valuable material. The quality and cost of the reclaimed paint will depend largely upon the care which is taken in collecting the overspray.

Do not mix two types of overspray. However, where segregation is not practicable, the reclamation of a mixture of two or more colors of mutually compatible types may be worth while.

Contamination of paint overspray with any type of foreign materials must be avoided.

Dried overspray, such as scrapings and sweepings, should not be added to the water-wet overspray to be reclaimed. Where a relatively non-oxidizing finish is sprayed, the dried overspray may be reclaimable into usable material, if scraped off frequently and immediately placed under water.

Collected overspray should be kept covered with water at all times to avoid oxidation. Once oxidation occurs, the overspray is beyond recovery as a useful material.

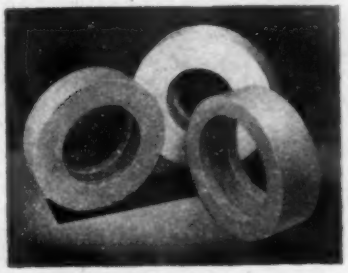
In the operation of a water-wash spray booth, it is generally necessary to add a chemical to the water to keep the overspray from fouling the flood sheet, nozzles, and the circulating system. Although these may function efficiently, they may not yield a reclaimable material. The following general principles should cover the use of overspray recovery agents: use the minimum amount necessary to keep the spray booth system clean and to yield a reclaimable material; keep a record of additions of compound and of the alkalinity of the water; this data should accompany each lot of overspray, to help the reclaimer.

Returns should be made in clean, open-head drums. The original container will be satisfactory if uncontaminated with skins. Drums that have previously contained asphalt, lubricating oil, cutting oil, etc., will contaminate the material so that it cannot be successfully reclaimed. At least 4 in. of water should be placed on top to prevent oxidation. Collected overspray should not be stored for prolonged periods before processing, nor held above normal temperature.

ON EVERY FRONT - She Serves!

HATS off to the ladies! In the Navy, Army, Coast Guard, Marines, they serve. Important, too, is the place women hold in industry today . . they handle grinding machines like experienced workmen!

The ease with which women have taken their place in war plants can be attributed to several factors, prominent among them being correct grinding wheels for the job. Different wheels often have to be used on machines run by women since their work technique is often different from that of men. Figuring this difference has resulted in wheels that turn out as much work under women's supervision as was possible when men were at the machines! Often, a sizeable increase has been noted!



Speed up production with Sterling Centerless Grinding Wheels built to solve your particular problem.

The close cooperation of Sterling engineers with plant managers has often saved time and increased quality. Especially has this been true in plants suddenly compelled to go to feminine labor . . experience on hundreds of similar jobs makes the Sterling engineer a very handy man to have around when sudden changes may make equipment obsolete unless proper steps are taken. Ask for it.

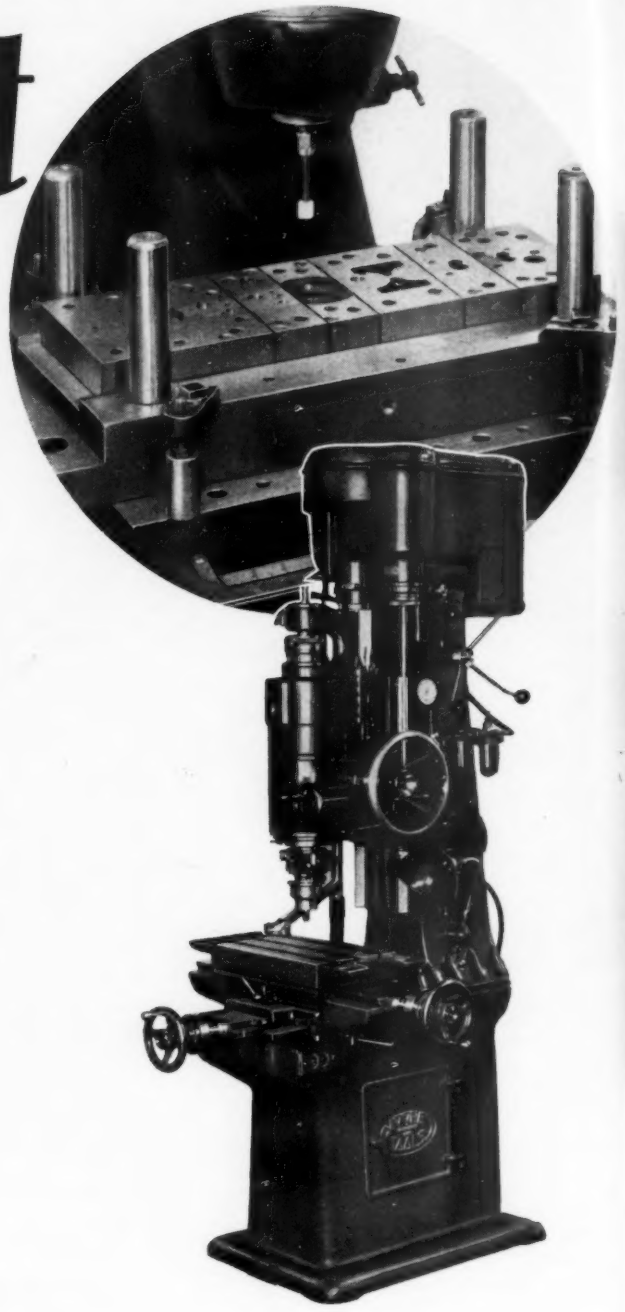
• STERLING ABRASIVES •

THE STERLING GRINDING WHEEL DIVISION
OF THE CLEVELAND QUARRIES COMPANY
TIFFIN, OHIO

THE WHEELS OF INDUSTRY

Correct HOLE DISTORTIONS *Easily*

with the MOORE JIG GRINDER



Specifically created to correct hardening distortions after boring, the Moore Jig Grinder is the product of years of work and research on the part of Moore engineers, tool and die specialists. This distinctive machine tool marks a milestone in the progress of efficient, precision tool-making. It has a definite place in every modern toolroom.

With speed and ease, the Moore Grinder accurately relocates and finish-grinds holes, straight or tapered on both hard and soft work, within .0001". Besides saving tool-room time, it increases the life of a die from two to twenty times that of an unground die. It has a capacity to grind holes from .030" to 4", accuracy of screws of .00005" per inch, grinding speeds of 15,000 to 45,000 RPM.

Partners in Production

The Moore Jig Borer is the "Production Twin" of the Moore Jig Grinder. Both machines incorporate the Moore system of coordinate location, permitting accurate spotting, drilling, reaming and boring in one uninterrupted sequence in the case of the Borer and accurate relocation and finish-grinding in the case of the Grinder.

The Moore Jig Borer is easy to operate, solves layout and jig-boring problems, produces more holes to closer tolerances in less time. It is sensitive for holes of 1/32" or smaller, yet rigid for heavy cuts, as in the operation requiring the increasing of a 2" hole to a precise 2½" diameter in one cut under power feed.

Discover how these two machines and their time-saving accessories can modernize your toolroom operations. Write today for descriptive catalogs.

MOORE SPECIAL TOOL COMPANY INC

740 UNION AVENUE, BRIDGEPORT. CONN.

Arm Your Screw Driving Army for SPEED TACTICS

TIME STUDY REPORT
OPERATION 15010 PIECE NO. 23
DATE Apr 22-42 TIME 3-4 P.M.
COMPARISON Power driving of screws with Phillips Recessed Head and ordinary slotted screws.
WORKING BADGE NO. 3491 SEX Male AGE: 42
NO. OPERATIONS STUDIED All screws for unit 15010
MORE ANALYSIS: Both ordinary slotted head screws were used 15 min. Too to drive. The screws with the Phillips Head only 11 min. 45 sec.
It's faster

SPEED-UP WITH PHILLIPS SCREWS!

Give your assembly line Phillips Recessed Head Screws and you'll give them the ammunition to clean up lagging assembly jobs on the double-quick!

In most cases, change-overs to Phillips Screws have cut driving time in half! All of the screw driving troubles that slow-up work are eliminated by the Phillips Recessed Head. The scientific recess, by automatically centering the driving force, prevents fumbling, wobbly starts . . . prevents slant-driven screws . . . burred and broken screw heads . . . dangerous screw driver skids.

The Phillips Recess lends "old-hand" skill to the newest newcomer . . . makes fast, faultless driving automatic. It permits power or spiral driving on almost any job.

They cost less to use! Compare the cost of *driving* Phillips with that of slotted head screws. You'll realize that the price of screws is a minor item in your total fastening expense . . . that it actually costs less to have the many advantages of the Phillips Recess!

KEY TO FASTENING SPEED AND ECONOMY

The Phillips Recessed Head was scientifically engineered to afford:

Fast Starting – Driver point automatically centers in the recess . . . fits snugly. Screw and driver "become one unit." Fumbling, wobbly starts are eliminated.

Faster Driving – Spiral and power driving are made practical. Driver won't slip out of recess to injure workers or spoil material. (Average time saving is 50%.)

Easier Driving – Turning power is fully utilized by automatic centering of driver in screw head. Workers maintain speed without tiring.

Better Fastenings – Screws are set-up uniformly tight, without burring or breaking heads. A stronger, neater job results.

PHILLIPS *Recessed Head* SCREWS

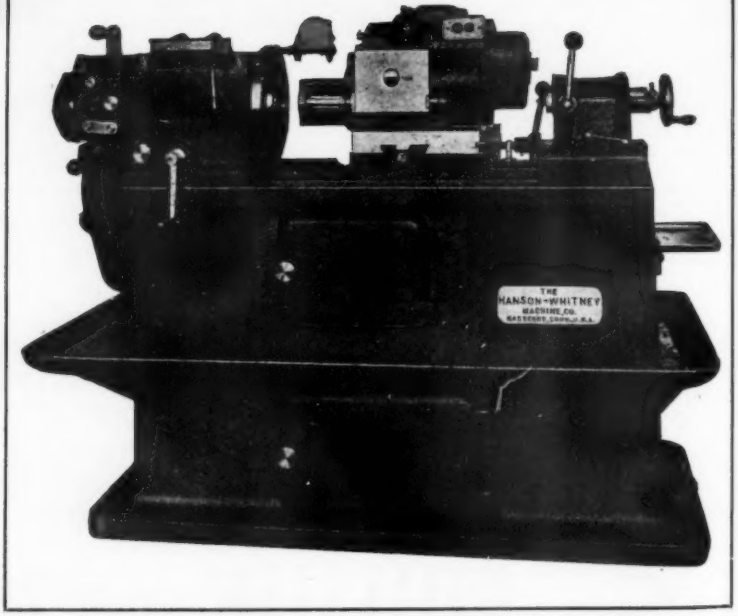
WOOD SCREWS • MACHINE SCREWS SELF-TAPPING SCREWS • STOVE BOLTS

21 SOURCES

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

Across the Pacific

Victories are won by superior equipment. H-W Semi-Automatic Thread Milling Machines are winning production victories . . . by saving precious time in thread production . . . by minimizing spoilage . . . by securing highest precision on difficult work. The H-W Milling Process employs multiple cutters that finish threads in one revolution . . . producing internal, external or taper threads . . . right or left hand . . . with equal speed, facility and precision. If you have a threading problem, call Hanson Whitney.



ARMY E NAVY

THE HANSON WHITNEY MACHINE CO.

HARTFORD CONNECTICUT U.S.A

Hundreds of War Plants have increased output with Gulf Cutting Oils and Gulf Super-Quench —

A long list of vital parts for the nation's war machine are being made *faster* and *better* because Gulf Cutting Oils and Gulf Super-Quench are doing such an outstanding job!

Hundreds of war plants have increased production and obtained many other worth-while benefits directly as a result of the superior performance of these quality Gulf products.

Here's the important reason for the remarkable results obtained with Gulf Cutting Oils and Gulf Super-Quench: They have been engineered for today's metal-working production problems — with unique properties which set them apart from conventional oils of the same type.

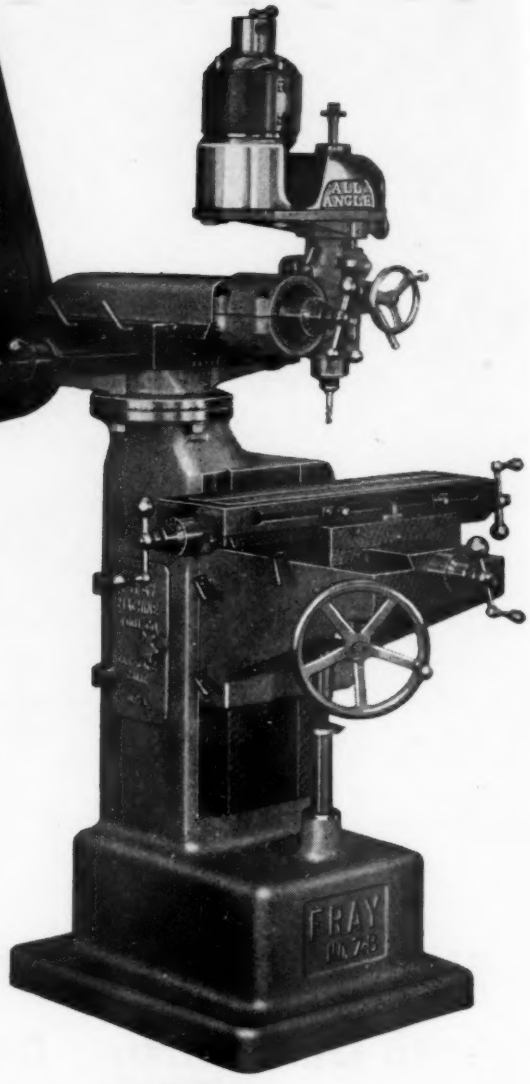
If you machine or heat treat steels, it will pay you to investigate—call in a Gulf Lubrication Service Engineer today and let him demonstrate Gulf Cutting Oils and Gulf Super-Quench in *your* plant. He can help you improve your machining and heat-treating practice.

Gulf Oil Corporation · Gulf Refining Company
GULF BUILDING, PITTSBURGH, PA.

If you machine or heat treat steels, it will pay you to investigate the advantages of these outstanding Gulf products—call in a Gulf Service Engineer for a demonstration

GULF INDUSTRIAL LUBRICATION

FRAY PRECISION TOOLS *Serving* The Production Fronts



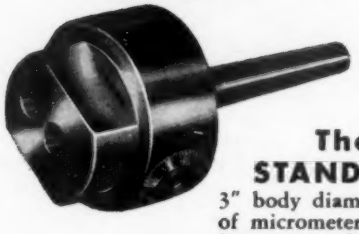
RAM TYPE No. 7-B

Vertical Universal Milling Machine

Without changing the work set-up, machining operations can be done at any angle in either or both the vertical and horizontal planes. All movements of the head are accurately controlled with calibrated dials. The maximum of flexibility desired by tool makers is a feature of the Fray No. 7-B Machine.

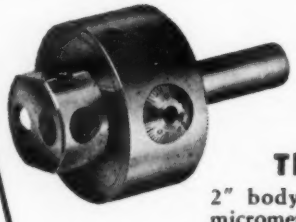
MICROMETER OFFSET BORING HEADS

Hundreds of firms now have Fray Boring Heads in their tool cribs for FAST, PRECISION WORK. Time is saved and guess work eliminated with the calibrated off-set adjustment dial. Three tool holes provide wide flexibility of service, with only two boring bars. Exclusive design maintains accuracy.



The STANDARD

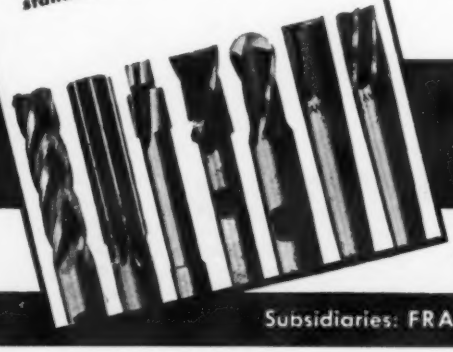
3" body diameter... ½" of micrometer offset adjustment... dial set flush with 50 graduations of .001" each... shank tapered and tapped for draw-in bolt... No. 7 Brown & Sharpe or No. 2 Morse taper arbors standard (special arbors furnished on request)... two ½" boring bars furnished with Head.



The JUNIOR

2" body diameter... 5/16" of micrometer offset adjustment... dial calibrated in .001"... straight shank... two ⅜" boring bars furnished with Head.

Users of FRAY Milling Machines and All-Angle Milling Attachments are ASSURED of a dependable source of End Mills, through the Fray Tool & Reamer Co. All standard types and sizes.



FRAY MACHINE TOOL CO., INC.

517 West Windsor Road, Glendale, California

Manufacturers of: *All-Angle Milling Attachments, Milling Machines, Offset Boring Heads and Boring Bars.*

Subsidiaries: FRAYCO ELECTRIC MOTORS CO., FRAY TOOL & REAMER CO

Meehanite Foundries

Allentown, Pa.
Traylor Engineering Company
•
Ansonia, Conn.
Farrel-Birmingham Co., Inc.
•
Bridgewater, Mass.
The Henry Perkins Co.
•
Brooklyn, New York
E. W. Bliss Company
•
Buffalo, N. Y.
Pohlman Foundry Co., Inc.
•
Charleston, W. Va.
Kanawha Manufacturing Co.
•
Chattanooga, Tenn.
Ross-Meehan Foundries
•
Chicago, Ill.
Greenlee Foundry Company
•
Cincinnati, Ohio
Cincinnati Grinders Incorporated
The Cincinnati Milling Machine Co.
•
Cleveland, Ohio
Fulton Foundry & Machine Co.
•
Denver, Colo.
The Stearns-Roger Mfg. Co.
•
Detroit, Mich.
Atlas Foundry Co.
•
Flint, Mich.
General Foundry & Mfg. Company
•
Hamilton, Ohio
The Hamilton Foundry & Machine Co.
•
Hamilton, Ontario, Canada
Otis-Fensom Elevator Company
•
Irvington, N. J.
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Elliott Company
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Los Angeles, Calif.
Kinney Iron Works
•
Milwaukee, Wis.
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Mt. Vernon, O., Grove City, Pa.
Cooper-Bessemer Corporation
•
New Rochelle, N. Y
Meehanite Metal Corporation
•
New York, N. Y.
The American Brake Shoe Co.
•
Oakland, Calif.
Vulcan Foundry Company
•
Orillia, Canada
E. Long, Ltd.
•
Philadelphia, Pa.
H. W. Butterworth & Sons Co.
Florence Pipe Foundry & Machine Co.,
(R. D. Wood Company, Selling Agents)
•
Phillipsburg, N. J.
Warren Foundry & Pipe Corp.
•
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Rosedale Foundry & Machine Co.
•
Portland, Oregon
Crawford & Doherty Foundry Co.
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Washington Iron Works
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London, Eng.
The International Meehanite
Metal Co., Ltd.
•
Waterloo, N. S. W.
Australian Meehanite Metal Co., Ltd.
•
Johannesburg, South Africa
Meehanite Metal Co. (S.A.) (Pty.) Ltd.

Meehanite QUENCHING DIES *speed propeller production*

A critical operation in the manufacture of hollow steel propeller blades for airplanes by the American Propeller Corporation, Toledo, Ohio, is quenching the blades during the heat treatment. This gives a hard surface to resist the pitting action of sand, dust, etc. To prevent distortion during quenching the blades must be held firmly under pressure in dies, through which cooling water flows in cored passages.

For the quenching dies shown above, Meehanite was used because its smooth, uniform, dense surface is an important advantage. In addition, the fact that Meehanite can be cast accurately to size and shape reduces the finishing operations required in making the dies, and assures correctly proportioned cored openings.

This application indicates how the special qualities of Meehanite are utilized in various industrial manufacturing processes. Perhaps Meehanite could solve a problem for you. Write for full information on the various types.

MEEHANITE RESEARCH INSTITUTE · New Rochelle, N.Y.

MEEHANITE
SEND FOR BOOKLET

Bulletin No. 11
"Meehanite the Metal for Cast-to-Form Dies"

MORE PRODUCTION WITH LESS TOOLS ...

Inventory Cut from 38,500 to 15,000 Tools In Three Months ...

in the Springfield Armory

TOOL INVENTORY SLASHED WITH McCASKEY CONTROL

"Controlling Tool Issue and Use, Springfield Armory, Springfield, Mass.", an article in a recent issue of Factory Management and Maintenance, outlines several steps taken to conserve tools and productive time. A few brief extracts contain valuable suggestions for other plants engaged in war work.

"Tool Control at the Armory consists of maintaining proper inventories, tool responsibility, and tool improvement. To obtain these factors, we make full use of a standard system of tool control altered slightly to meet our particular requirements.

"When this system was first installed, our total inventory was approximately 38,500 tools. After three months, this inventory had been reduced to 15,000 tools. Loss of productive time by personnel going from one department to another to find some particular tool also has been eliminated.

"The activity record gave us a yardstick by which we could measure the amount of work in each crib and on each shift, enabling us to employ our personnel to best advantage."

TOOL RESPONSIBILITY FIXED FOR THREE SHIFTS

"To obtain a tool, a man must make out a tool loan order form. Thus we know who has drawn the tool and who is responsible for it. The man who drew the tool knows he signed for it and is held responsible for it. He will see that it is returned to the crib. Our experience has definitely proved this statement.

"We do not necessarily have the man who drew the tool return it. Anyone may return it, but he must initial the pink copy. He then secures the original copy of the tool loan order slip and posts it in a clip on the machine. This enables the man who originally obtained the tool to destroy his own receipt, even though he may be on another shift. We find that the men working on the machine on each of the three shifts willingly cooperate with one another for mutual protection."

Space limitations prevent an account of how breakage has been reduced and "considerable information gained about problems in the shop that otherwise would have been secured only after a thorough investigation."

SENT FREE ON REQUEST

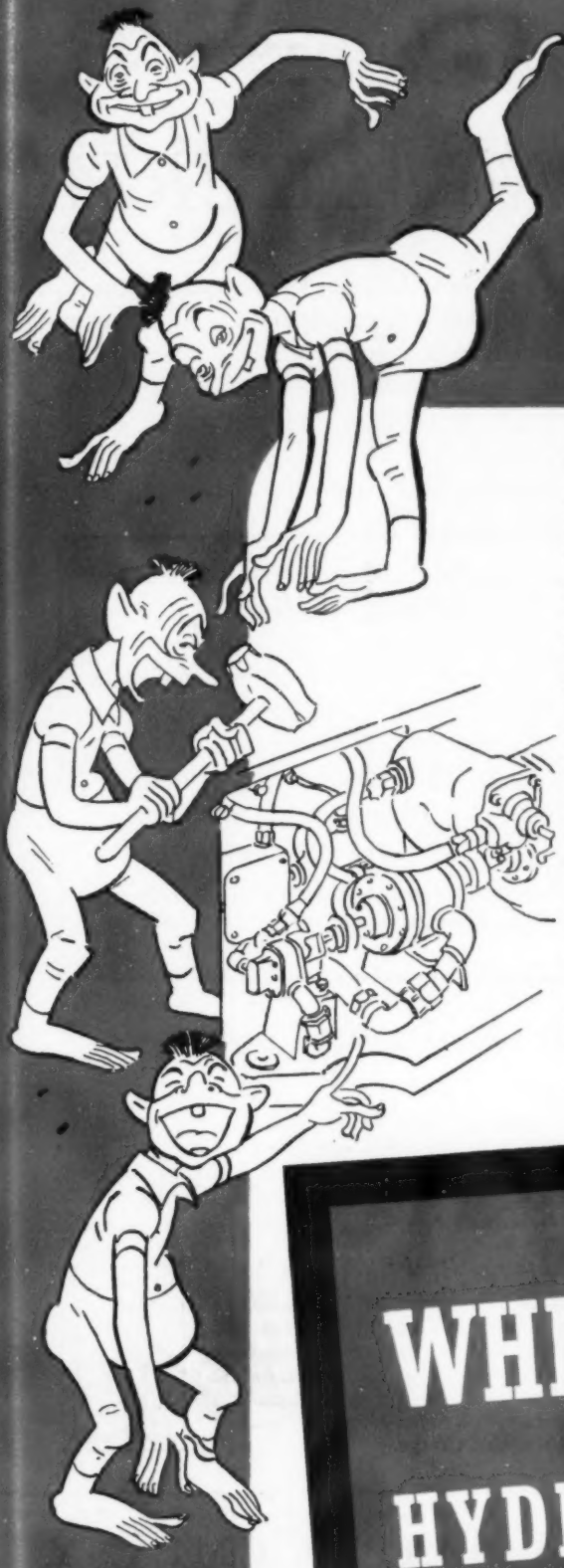
Reprint of complete article and similar reports of the experiences of several representative plants with McCaskey Tool Crib Control.

THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCaskey Systems Ltd., Galt, Ontario, Canada — *The McCaskey Register Co., Watford, England*

McCASKEY INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • MAINTENANCE • TOOLS • COSTS • PAYROLL



Keep the Gremlins Away

FROM YOUR HYDRAULIC EQUIPMENT

● Precipitation of gum and sludge, with sticking valves and clogged orifices, open the way for the gremlins of wear, damage and delay.

En-Ar-Co White Rose Oils, characterized by unsurpassed oxidation stability under critical service, withstand the destructive effects of high pressures, heat, moisture, and the catalyzing effects of metal particles.

For longer service life under today's working conditions En-Ar-Co White Rose Oils are specified with complete confidence.

National Refining Company engineers will be glad to work with you in increasing the service and satisfaction of your hydraulic machinery. Write today.

EN-AR-CO WHITE ROSE OILS FOR HYDRAULIC SYSTEMS

THE NATIONAL REFINING CO.

Cleveland · Indianapolis · Chicago · Peoria · Omaha · Kansas City · Memphis

East of Ohio... The Globe Refining Company, Cleveland, Ohio

EN-AR-CO INDUSTRIAL LUBRICANTS

FACTS *you should know about* HARD-FACING MATERIALS

By means of hard-facing—which is the process of welding on to wearing parts a coating, edge, or point of a hard metal—it is possible to protect metal surfaces that normally wear away rapidly in service. This method not only makes industrial parts last from two to twenty-five times longer, but also reduces time lost for replacements, lowers power consumption, and helps to maintain high efficiency. In addition, hard-facing often makes possible the use of substitute base metals in the fabrication of parts. Outlined below are facts you should know when selecting hard-facing rods.

Properties Required for Hard-Facing

High-quality materials are required to obtain full benefit from hard-facing. The materials should possess the following properties:

1. Inherent hardness.
2. Resistance to abrasion.
3. "Red Hardness"—or the retention of initial hardness up to red heat.
4. Ease of application by ordinary welding techniques.
5. Resistance to high-temperature oxidation during application by welding.
6. A melting point slightly lower than that of steel, the usual base metal.
7. A coefficient of expansion close to that of the base metal.

Types of Materials Available

Group 1—These alloys are relatively low in cost. They are alloy steels consisting of an iron base with less than approximately 20 per cent of alloying constituents. *Example: Hascrome iron-base hard-facing rod.*

Group 2—These are iron-base alloys containing more than 20 per cent of alloying elements. They are useful for services involving more severe abrasive wear than the metals of group 1. *Example: Haynes Stellite "93" hard-facing rod.*

Group 3—This group is made up essentially of non-ferrous cobalt-chromium-tungsten alloys. Hardness is inherent and retained at high temperatures. *Example: Haynes Stellite grades 1, 6, and 12 non-ferrous hard-facing rod.*

Group 4—The fourth group consists of tungsten carbide "diamond substitute" materials, supplied in a variety of forms, and combining a maximum of wear resistance with cutting qualities when applied on the cutting edges of earth drilling tools. *Example: Haystellite composite rod, tube rod, and inserts.*

Send for Helpful Literature

Write for the booklet "*Hard-Facing Materials Data.*" It can be tacked on the shop wall for convenient reference on such points as the selection of the right rod, application techniques, and amount of rod required. A copy will be sent without charge.

HAYNES STELLITE TRADE MARK

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

New York, N. Y. UCC Kokomo, Ind.

Chicago—Cleveland—Detroit—Houston—Los Angeles—San Francisco—Tulsa

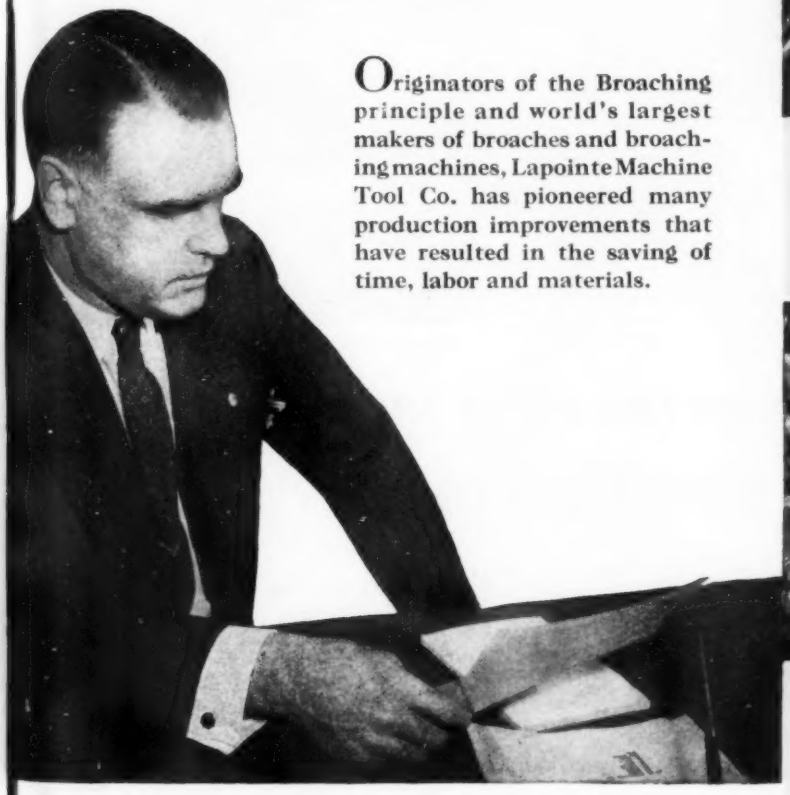
HARD-FACING RODS FOR EVERY PURPOSE

The words "Haynes Stellite," "Hascrome," and "Haystellite," are registered trade-marks of Haynes Stellite Company.

CUTTING TOOL TIPS FROM THE TOP-NOTCHERS—#5

"To insure good broaching results, broach, machine and set-up must be handled with utmost care,"

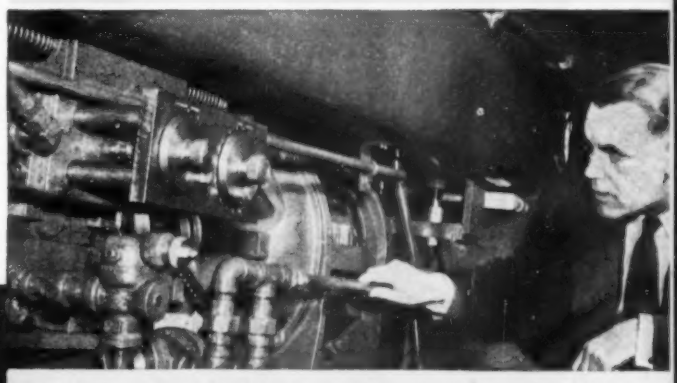
says JOHN J. PRINDIVILLE, Jr., Vice-Pres.
Lapointe Machine Tool Company
Hudson, Mass.



Originators of the Broaching principle and world's largest makers of broaches and broaching machines, Lapointe Machine Tool Co. has pioneered many production improvements that have resulted in the saving of time, labor and materials.

"The high-grade steel and many precision operations that go into the production of a broach make it an extremely valuable piece of equipment. When not in use broaches should be protected with a rust preventive and carefully packed; either in their original crates or in racks made for that purpose."

"To insure the operating efficiency of machine and broach, the care of the broaching machine should be made a daily routine. Special attention should be given to the selection of the coolant and the hydraulic oil used. In the above photograph Mr. Cambria, our design engineer, points out the features of a gun-rifling machine."



"While most broaching machines have one-shot oilers, proper lubrication is still an important function, as is the proper setting of stops and controls. Most job set-ups on our machines are relatively easy to do because of special fixtures. However, constant care in setting up fixtures and putting in pieces will save unnecessary spoilage of both piece and broach."

"To determine whether or not a job can be broached, complete information as well as prints and samples of the job must be thoroughly checked. On the particular machining job being discussed, estimates show over 50% can be saved by broaching."

The correct cutting oil is as important to proper broaching operations as the correct care and operation of the broach and the machine. That's why Shell has developed a control technique that "balances" the oil to the machine, the application and the tool. Call in the Shell man now for details.

SHELL

SHELL LATA OILS
FOR METAL WORKING

NICKEL AIDS THE AUTOMOTIVE INDUSTRY

to KEEP 'EM ROLLING!

Using ingenuity and "know-how" born of long experience, automotive engineers designed the phenomenally successful transport equipment that now speeds the United Nations on the road to Victory.

Built to take punishment far above peacetime requirements, these specialized military vehicles are being produced in quantity by the mass-production methods that have amazed the world. From North Africa to the South Pacific, these trucks, jeeps, tanks and half-tracks have repeatedly met wartime demands for stepped-up performance.

This kind of engineering-thinking pioneered the application of Nickel alloyed materials. Now, when uninterrupted operation is so vitally important, the continued and widespread use of Nickel is clear evidence of its many advantages.

In steering knuckles or differentials, in forged gears or cast blocks, a little Nickel goes a long way to provide essential dependability. It improves strength/weight ratios, increases wear and corrosion resistance, imparts toughness, and assures uniform properties of the other metals with which it is combined.

Today, maintenance crews on far-off battle fronts are learning what metallurgists and engineers here long have known . . . that, properly used, Nickel aids to "keep 'em rolling."

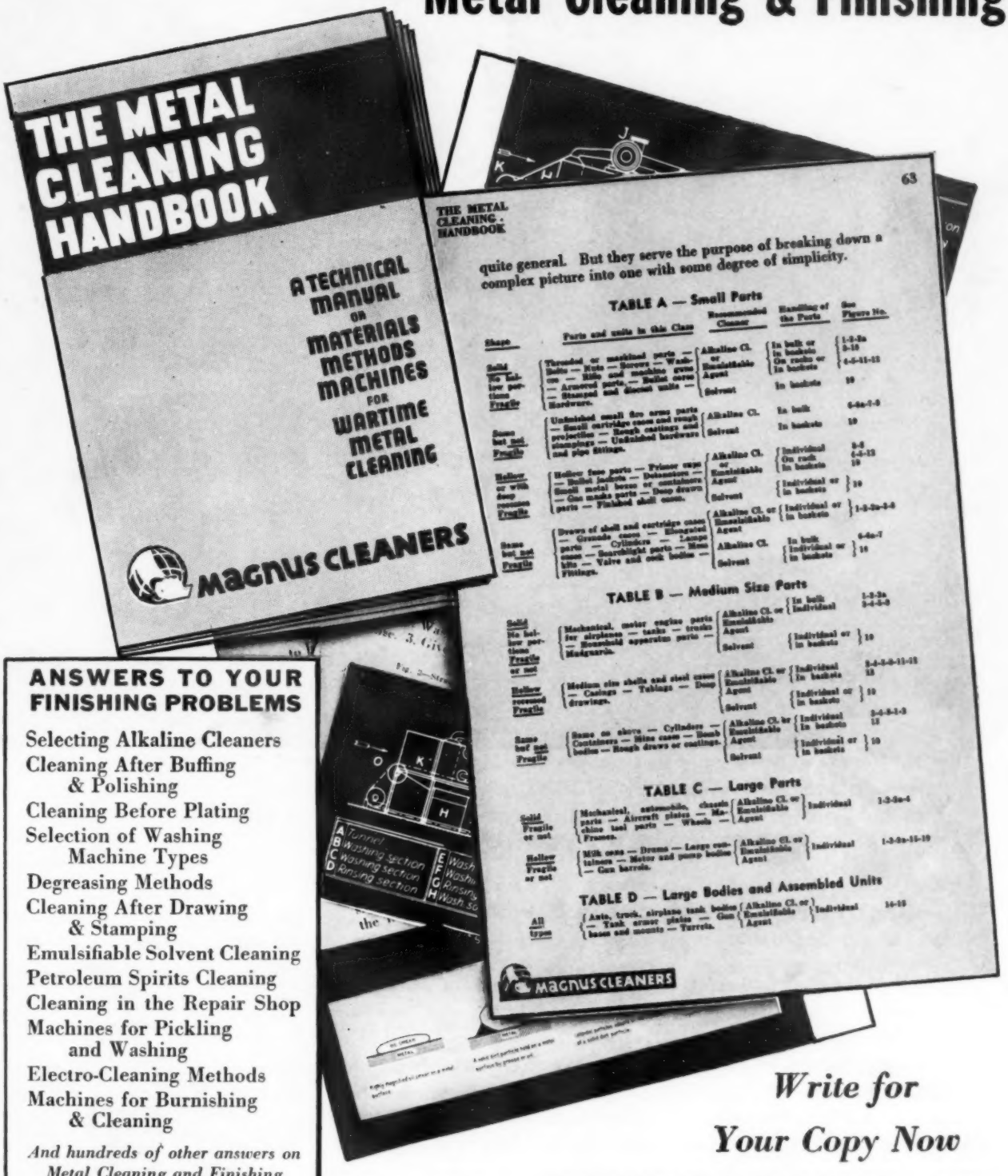
For years the technical staffs of International Nickel have been privileged to cooperate with automotive engineers and production men . . . men whose work is now so necessary to the Nation. Counsel, and printed data about the selection, fabrication and heat treatment of ferrous and non-ferrous metals is available upon request.

★ *Nickel* ★

For lists of current publications, please address Technical Library Service

THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall St., New York, N.Y.*

The Only COMPLETE Manual on Metal Cleaning & Finishing


THE METAL CLEANING HANDBOOK
A TECHNICAL MANUAL ON MATERIALS METHODS MACHINES FOR WARTIME METAL CLEANING
Magnus CLEANERS
THE METAL CLEANING HANDBOOK
63
quite general. But they serve the purpose of breaking down a complex picture into one with some degree of simplicity.
TABLE A — Small Parts
TABLE B — Medium Size Parts
TABLE C — Large Parts
TABLE D — Large Bodies and Assembled Units
Magnus CLEANERS

ANSWERS TO YOUR FINISHING PROBLEMS

- Selecting Alkaline Cleaners
- Cleaning After Buffing & Polishing
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And hundreds of other answers on Metal Cleaning and Finishing Operations

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Magnus CLEANERS-METHODS-MACHINES

OWI Photo by Palmer, in an Allegheny Ludlum Plant

R FOR ALLOY STEEL

[Accurate to 1/1000 of 1 per cent]

QUALITY in the manufacture of stainless steel—that is, high fidelity to the properties required, and consistent uniformity over shipment after shipment—requires constant control and research.

In Allegheny Ludlum laboratories, chemists weigh the elements of each stainless melt to determine its exact composition. Analysis is determined to 1/1000 of 1%, for each element in the steel. Nothing is left to chance that will prevent waste of these vital alloys, or protect the faithfulness of the steel to specifications.

That is the background of Allegheny Stainless when it comes to you as a raw material. And it's only half the story. The major importance today lays in what you *do* with the steel . . . how fast you turn it into finished war equipment and parts; how little of it is wasted in rejects or spoilage. Stainless steel is a critical material; even the use of a high alloy, where a lower one would do the job, is a loss out of the nation's reserves.

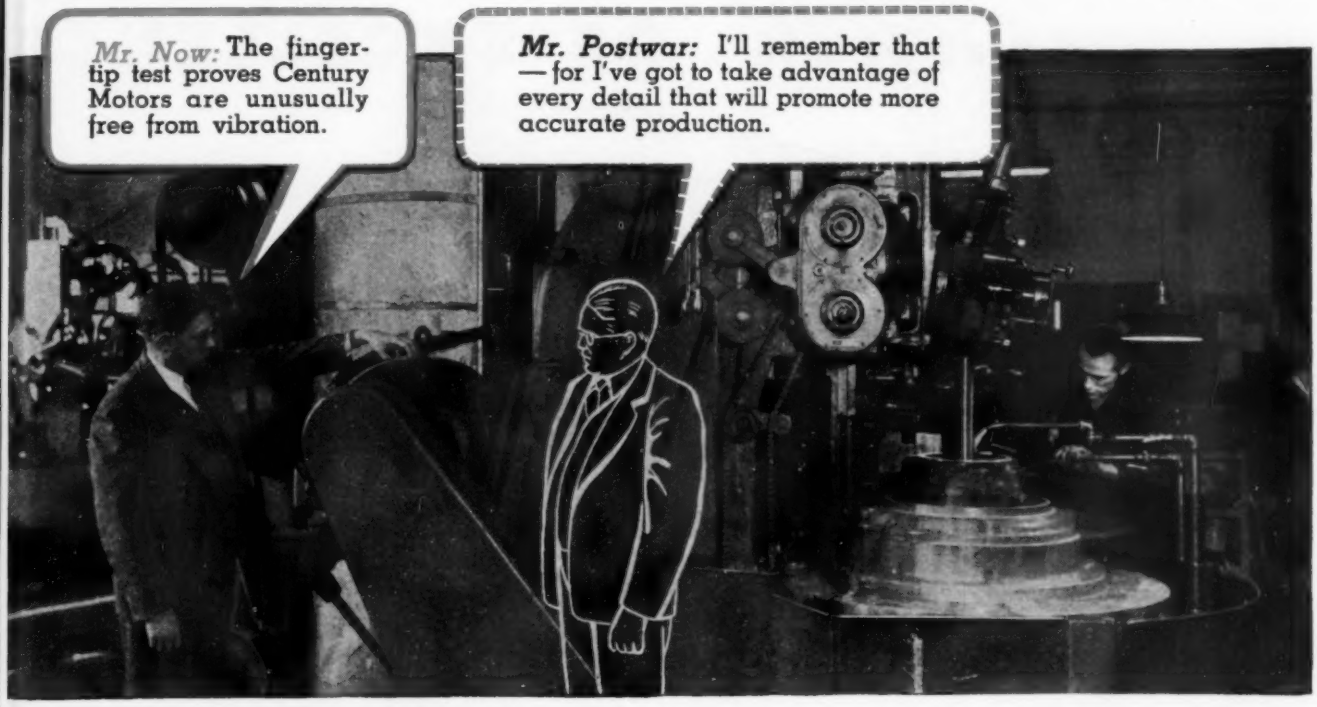
• Can you improve your use of stainless, either to save time or material? Our help, printed or personal, is at your service.

ADDRESS DEPT. AM-7

Allegheny Ludlum
STEEL CORPORATION
BRACKENRIDGE, PENNSYLVANIA

A-8843 . . . W & D

Take a Look at TOMORROW—*Today!*


Mr. Now: The finger-tip test proves Century Motors are unusually free from vibration.
Mr. Postwar: I'll remember that — for I've got to take advantage of every detail that will promote more accurate production.

CENTURY MOTORS'

Unusual Freedom From Vibration Helps Machine Tool Accuracy

On today's production front, Century Motors' unusual freedom from vibration is recognized as being of vital importance where quietness, accuracy, and precision work are all-essential.

Not only the rotational balance of Century Motors, but their design—which includes magnetic proportions, end-bumpers, rugged frames, extreme rigidity, and accurately machined feet—contribute to this extremely valuable feature. You can easily test it by placing your finger-tips on a running motor!

Out of the demands of Wartime production, where so often tolerances must be held to the closest limits, are being developed even *finer* Century Motors. It will pay you to remember Century in your present and postwar planning.

CENTURY ELECTRIC CO. 1806 Pine Street, St. Louis, Mo.
Offices and Stock Points in Principal Cities

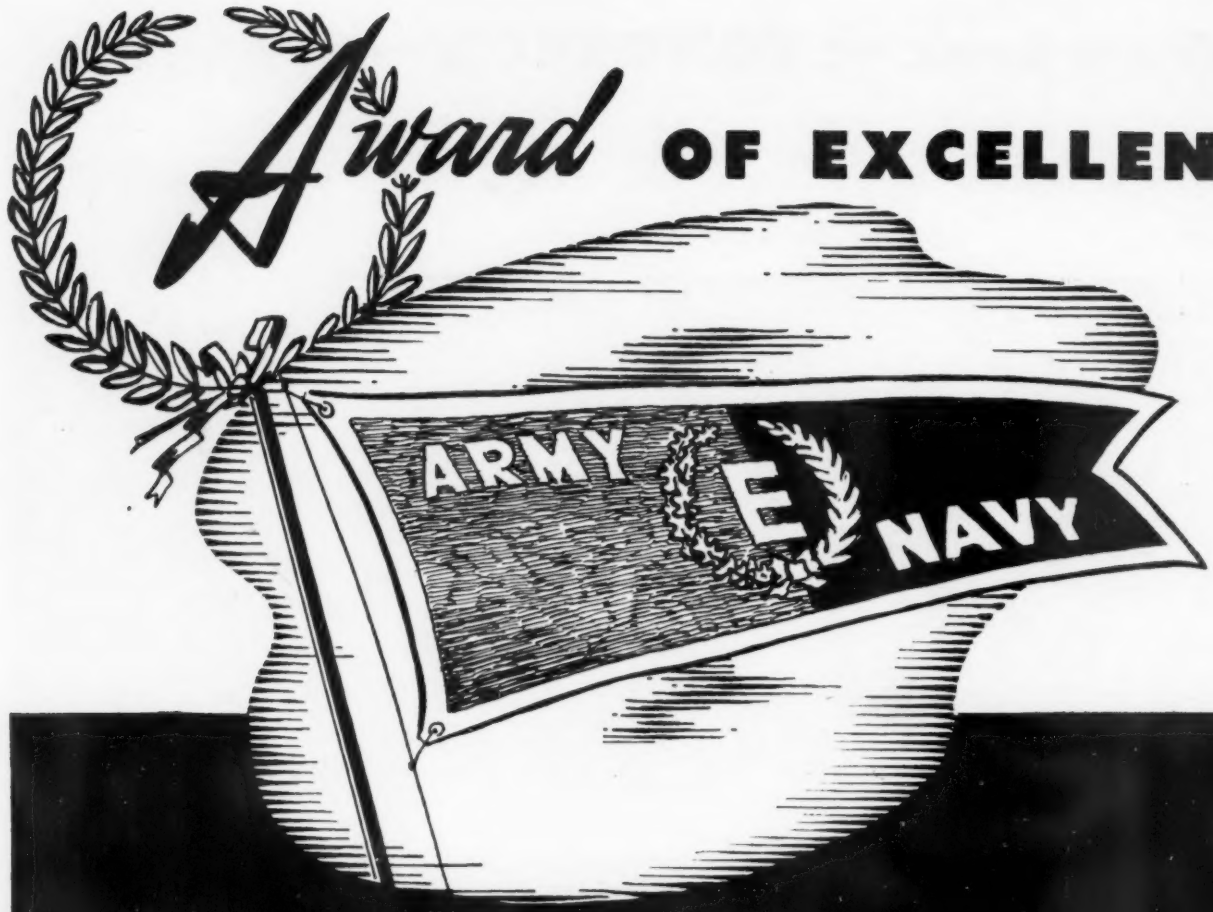
Century MOTORS

Century Motors are available in a wide variety of types from 1/6 to 600 horsepower.

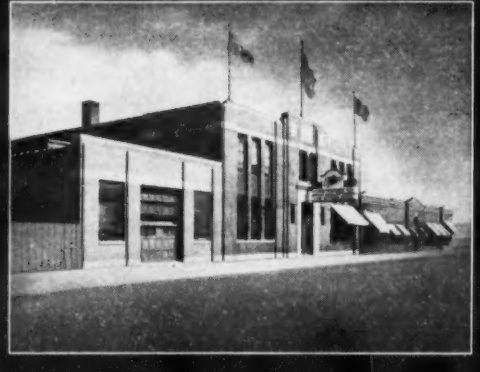
323

One of the Largest EXCLUSIVE Motor and Generator Manufacturers in the World

Award OF EXCELLENCE



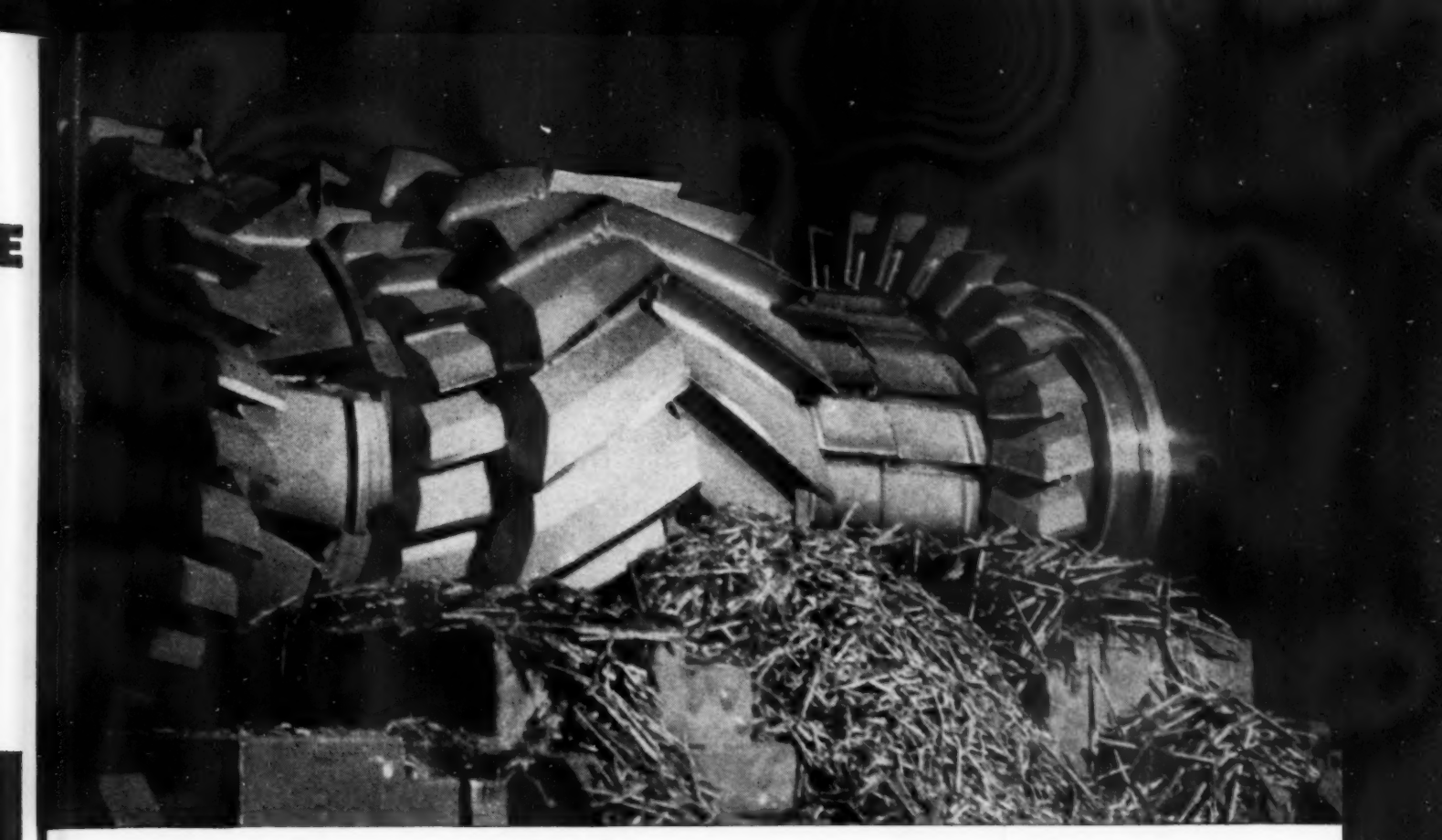
In receiving the joint citation of the Army and Navy the men and women of Eclipse recognize that the award carries with it not only an honor but a responsibility. The coveted "E" Award flags flying above the two Eclipse plants inspire a patriotic glow in the heart of every Eclipse man and woman . . . an inspiration to an even greater accomplishment in our common objective . . . VICTORY! Our customers are assured that Eclipse employees will continue increasing and INCREASING the flow of Eclipse Cutting Tools until this war is safely over.



Eclipse

ECLIPSE COUNTERBORE COMPANY

TWO COMPLETE PLANTS IN DETROIT AND FERNDALE, MICHIGAN



Cutters Give You More Production When You Give Them More Care

Follow These Simple Suggestions · They Will Help You Increase Your Production

HANDLE CUTTERS carefully to prevent damage to the cutting edges.

HAVE THE WORK CLAMPED AND SUPPORTED PROPERLY. Work not held rigidly can cause premature cutter wear or even breakage.

MOUNT CUTTERS as closely as practicable to the spindle.

USE ARBORS OF SUFFICIENT DIAMETERS. Insert arbor shanks carefully in thoroughly cleaned taper holes. Ends of collars should not be bruised. Provide adequate arbor support.

RUN SMALL CUTTERS (such as end mills) at the same surface speed as that used for larger cutters.

KEEP CUTTERS SHARP. When cutters are used after they have become dull excessive metal is lost in sharpening. On a production job, sharpen cutters after a predetermined number of cuts regardless of wear.

IN SHARPENING, control cutter clearance carefully and remember softer metals may require several times the clearance of cutters for iron and steel.

COUNTERACT CHATTER. Incorrect clearance and lack of rigidity of machine or cutter drive contribute to chatter which can cause abnormal cutter wear.

BE SURE MACHINE IS HEAVY ENOUGH to stand the cut and use the correct spindle speeds with each setup. Supply ample coolant where it is required.

Give cutters extra care these days when the supply available is limited so that the production requirements for our armed forces can be maintained.

We are proud to be honored with the Navy "E", awarded for outstanding accomplishment in Defense production.
Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.
BS

Reproductions of this advertisement for use on your bulletin board furnished on request.

BROWN & SHARPE CUTTERS

METEX COOLANT STRAINER

THE INEXPENSIVE EFFICIENT COOLANT STRAINER

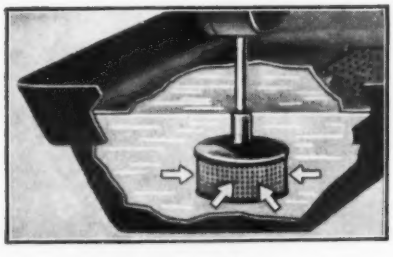
(U. S. Pat. 1676191—Other Pats. Pending)

Cylindrical Type

Adaptable to most Machine Tools...all easily installed, vertically or horizontally, singly or in multiple.

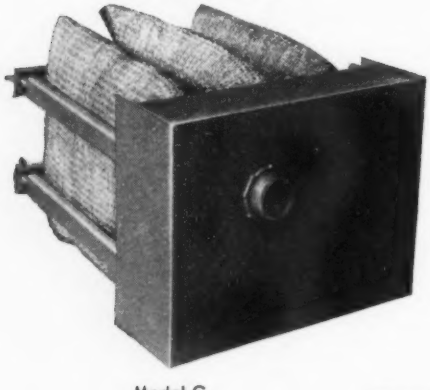
MODEL C

- **Cylindrical Type (size adapted to most machines). Diameter—5" . . . Overall Height—4 5/32" including coupling. Capacity up to 10 G.P.M.—¾" pipe. *Other sizes, surface areas and capacities, this type, Model* A, B and D.**



Typical Installation

Metex Coolant Strainers in machines equipped with gear pump coolant systems (or centrifugal pumps that have an intake pipe extending into the tank) will strain chips and slag remaining in suspension, save pumps, gears, unnecessary machine wear, and will boost and maintain production.



Model G

MODEL G and H *(Oblong Type)*

- Are constructed to remove fine residue (grindings, etc.) from the coolant fluid. Same installation as Cylindrical Type. While designed particularly for grinders and automatic screw machines, will give efficient service in all machines. Model H is especially adapted to those with shallow or narrow sumps.

Model H

BUY THEM BY THE DOZEN

Your machines are working on a 'round-the-clock production program. The coolant, being continually agitated, does not have a chance to settle, so you need the protection of these strainers NOW. Buy them by the dozen so as to have a supply in your stockroom to be installed when pumps are being repaired or replaced, or when machines are down for a short time.

Distributed by leading Mill Supply Wholesalers or direct from

METAL TEXTILE CORPORATION 4 Central Avenue, Orange, N. J.

DOW

Flight of planes always suggests the release of unfettered power. No material used in aircraft construction has done more to free these essential weapons of war from hampering weight than magnesium. An equal amount of *even any comparable light structural metal* would weigh 50 per cent more! Today Dow magnesium production capacity is many times greater than pre-war facilities provided. After Victory, designers will have full access to this vast production to lighten the load of practically everything that moves.

DOWMETAL

BONDS BUILD BOMBERS

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

MAGNESIUM

PRODUCER SINCE 1916

INGOTS · CASTINGS · FORGINGS · SHEET · STRIP · PLATE · EXTRUSIONS

P&H TRAV-LIFT CRANES

SPEAKING OF TEAMWORK

"We've teamed up for peak production. I press buttons and the P&H Trav-Lift moves the loads from here to there in a hurry."

That's typical of the important part P&H Trav-Lifts are playing in war production. And everywhere, there is increasing recognition of what modern materials handling equipment can do in speeding production, eliminating worker fatigue, cutting costs.

P&H Trav-Lift Cranes provide an extremely flexible handling service. They enable you to move any type of load from any given point to any other within the area they serve, without rehandling. Available in sizes up to 15 tons capacity with either cage or floor control. Literature on request.

General Offices: 4514 W. National Avenue, Milwaukee, Wis.

HARNISCHFEGER CORPORATION

ELECTRIC CRANES • EXCAVATORS • ARC WELDERS P&H HOISTS • WELDING ELECTRODES • MOTORS

ARMY E NAVY

A new star has been added P&H's award for excellence war production.

LOOK HOW EASY IT IS TO SHARPEN TANTUNG TOOLS!

#1 Use slightly less clearance angles than high-speed steel tools require. For off-hand grinding, a 46-grain aluminum oxide, abrasive, vitrified bonded wheel is best—60-grain if a better finish is desired. Straight wheel for roughing. Cup wheel for finish.

#2 Hand hone after grinding, to give the cutting edge even longer life. And when grinding, take it easy. "Light pressure" is the word with Tantung tools. Move edge back and forth across wheel face. Re-sharpen as soon as tool begins to show dullness or wear.

NEVER *Use Diamond Wheels . . .* NEVER *Quench in Water!*

Yes, sir! It's no job at all to sharpen Tantung tools. 'Most anybody can do it. So what's keeping *you* from increasing your production, cutting down lost time, *saving money* with Tantung?

What Is TANTUNG?

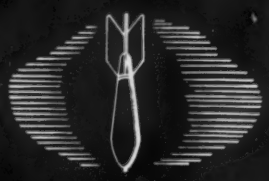
Tantung is the *only* cast, non-ferrous alloy containing tantalum carbide. It wears from *2 to 25 times* as long as high-speed steel—has a red hardness far above that of any steel. Tantung is strong and tough, and has a self-lubricating action that minimizes chip wear or "cratering." Tantung tools cut shutdowns, do a faster, cleaner, more uniform job. Specify Tantung tools for all work not suitable for carbides.

Joe Bloakes, the foreman said,
Was one of the world's biggest fools;
But even poor Joe—
not a brain in his head—
Could sharpen up Tantung tools!

VASCOLOY RAMET CORPORATION

NORTH CHICAGO, ILLINOIS · DISTRICT SALES AND SERVICE IN PRINCIPAL CITIES
IN CANADA: CARBIDE TOOL AND DIE COMPANY, LTD., HAMILTON, ONTARIO

4319



Who Wins Wars?

Strangely enough, the average man does! Much as we all detest war the fact is that under its stimulation a nation always develops new products with infinite peacetime applications. To date, scores of fantastic devices have been created for war purposes which one day will contribute mightily to the American Way of Life. Weatherhead is producing at the rate of *millions every day* many products that have peacetime application. Just as we've helped build cars, planes and refrigerators in the past, Weatherhead is well prepared to help you build the many new products of the future.

Look Ahead with

Weatherhead

THE WEATHERHEAD CO., CLEVELAND, OHIO
Manufacturers of vital parts for the automotive, aviation, refrigeration and other key industries.

Plants: Cleveland, Columbia City, Ind., Los Angeles
Canada—St. Thomas, Ontario

Compare them all...and you'll use

TOOLIFE
CUTTING BASE

Check these

TOOLIFE
Features

WETTING AGENT

carries lubricant closest to cutting point, resulting in maximum dissipation of heat and assuring

✓Longer Tool Life
✓Better Finish

UNIQUE FORMULA

used in making TOOLIFE has resulted in

✓Elimination of Dermatitis

YOU GET ALL THESE ADVANTAGES AND MANY MORE WITH

TOOLIFE
CUTTING BASE

WRITE TODAY FOR SAMPLE AND INTERESTING DESCRIPTIVE PAMPHLET

SPECIALTY
PRODUCTS COMPANY, INC.
190 WARREN STREET · JERSEY CITY, N. J.
Manufacturers of Sulphur, Lard and Soluble Cutting Oils and Bases

ADDITIONAL TERRITORIES STILL OPEN TO SALES REPRESENTATIVES. WRITE AT ONCE.

No adjustments necessary in a West-serviced plant. Today, the increased demands of war production have further proven the worth of West products, even when tested against the new problems created by the employment of women workers in heavy war industry.

LAN-O-KLEEN*

has *proven* its value in helping to prevent occupational skin diseases in many of the greatest war plants from coast to coast. Lan-O-Kleen is not only an effective cleaner that works mildly and without harsh chemical action—but, it leaves the hands feeling better, more ready for work. Lan-O-Kleen is a powdered soap of *mildly* alkaline reaction compounded with granular corn-meal, which has been impregnated (by an exclusive process) with LANOLIN, an oil almost identical to the natural oils secreted by the glands of the skin. Lanolin helps nature to maintain a normal, healthy skin condition.

*Trade Mark Reg. U. S. Pat. Off.

PROTECTIVE CREAMS

As a result of many articles on the subject, women workers are more than ever aware of the wisdom of using protective creams as an added precaution against dermatitis. But it is in the interest of management to provide workers with the PROPER protective cream—one that the West laboratories have prepared after careful research to best combat the hazards of dermatitis aggravated by those specific irritants peculiar to the various materials handled.

This new booklet sent on request . . . use coupon

55 BRANCHES • HELPING TO GUARD INDUSTRIAL HEALTH • COAST TO COAST

WEST DISINFECTING Company

42-16 WEST STREET • LONG ISLAND CITY • N. Y.

CLIP TO YOUR BUSINESS LETTERHEAD, PLEASE

West Disinfecting Company, Dept. AM, 42-16 West St., L.I.C., N.Y.
Please send me your new FREE booklet "Production Safeguards Against Dematitis".

Name .....Title .....

Hold it, MISTER!

...there's an easier way to end your motor problems

ask Westinghouse!

Simplify your problem *at the start*—draft Westinghouse "know-how". With 57 years of Westinghouse motor and control experience at your elbow, you'll find the *one best motor for the job* sooner—with certainty . . . whether it means new design, modification or selection of an existing type. For engineering aid...call or write your nearest Westinghouse office. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N.

J-21289

Proof?

see page 67

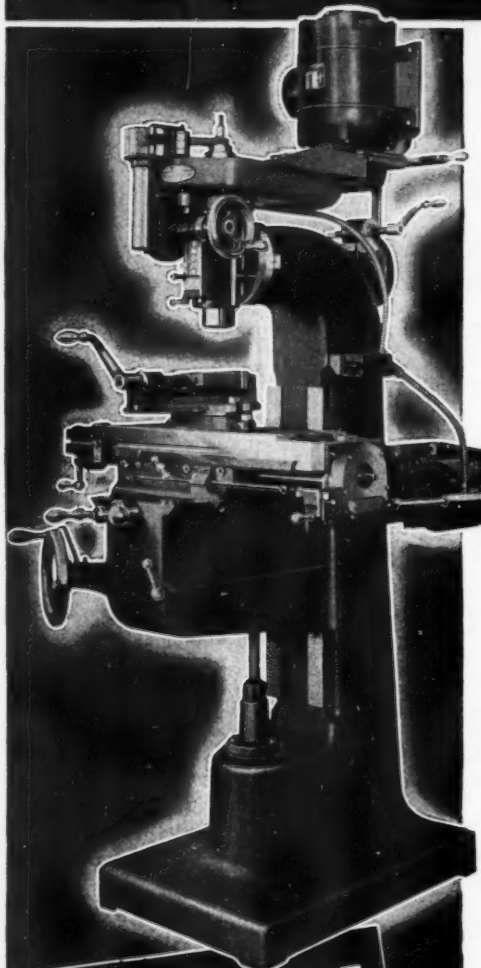
Westinghouse

MOTORS AND CONTROL

Accurate

AS THE GUNS THEY HELP PRODUCE

INDEX MILLS



Manufactured by Index Machine and Tool Co. Jackson, Michigan

CHECK THESE FEATURES!

★ Precision Ball Bearing Spindle that will require no attention for two years.

★ Swivel Head which can be set 90° right or left.

★ Super construction sensitive enough to do work with end mills ⅛" diameter yet rugged enough to use ¾" end mills taking full cuts 24 hours a day.

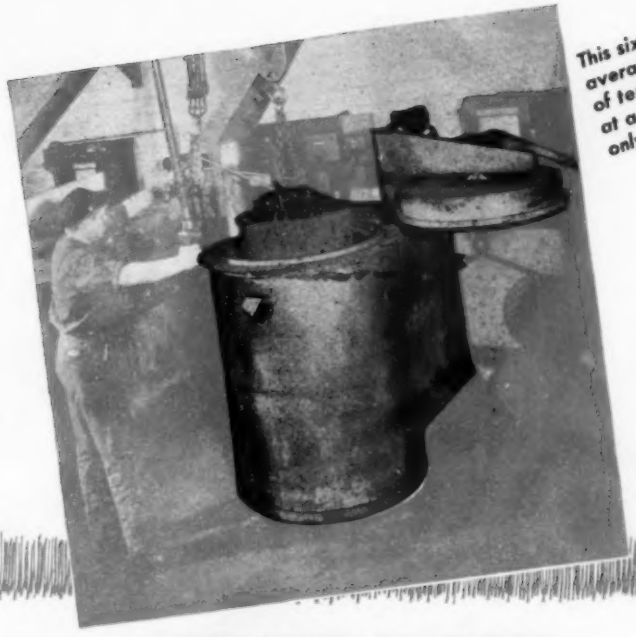
★ Verniers for locating, and power feed to spindle for boring.

★ A versatile machine that can be used in the tool room or on the production line.

Send inquiries for immediate quotation and quick delivery to Factory Sales and Distributing Agents.

BLANK and BUXTON MACHINERY

3100 E. MICHIGAN AVE.
JACKSON, MICHIGAN



This six year old Cyclone averages over 1500 tons of tempered parts per year at a maintenance cost of only 1c per ton!

6 year old CYCLONE averages 29½ tons of tempered steel per week!

IN JULY 1937, the gas fired Cyclone, shown above, started to turn out uniformly and accurately tempered parts at the rate of 9850 lbs. per day. The work was of various kinds and heated at different temperatures. Today, after almost six years of continuous service and the production of over 9,000 tons of work, this 22" diameter by 26" deep Cyclone is as efficient as the day it was installed.

1¢ PER TON!

Even with heavy production schedules, all of the replacement material, over the span of years, has been only $93.77, or 1 cent per ton average.

The Lindberg Cyclone Tempering Furnace, like all Lindberg equipment, is built to "take it." Before it is ever announced to the trade, each furnace has to pass the grueling gauntlet of several commercial production lines. It is worked on by heat treater and engineer alike until it can be honestly okayed as the "practical furnace for the practical heat treater."

BULLETIN 52 AVAILABLE

Bulletin 52, on the Gas Fired Cyclone Furnace, shows the wide range of sizes available, a cross section view showing the famous Lindberg recirculating principle, construction features and pictures of Cyclones at work on a wide variety of work. Bulletin 52 will gladly be sent on request. WRITE TODAY!

LINDBERG ENGINEERING COMPANY
2445 WEST HUBBARD STREET • CHICAGO

LINDBERG FURNACES

ARMY (E) NAVY

SUPER-CYCLONE for hardening, normalizing, annealing, tempering
CYCLONE for accurate, low-cost tempering and nitriding
HYDRYZING for scale-free and decarb-free hardening

J. K. SMIT & SONS

157 Chambers St., New York, N. Y. 6400 Tireman Ave., Detroit, Mich.

INDUSTRIAL DIAMOND TOOLS

Special
LIVE CENTER SET-UP REDUCES SCRAP

Battery of Ex-Cell-O Thread Grinders involved in operation

on vital aircraft engine part

Operator at N. A. Woodworth Company, Ferndale, Michigan, putting another part on specially designed Sturdimatic Live Center.

They had trouble with *dead centers*, during a precision grinding operation at N. A. Woodworth Co., because of deep scratching. Emery, in the coolant, was getting between dead centers and a highly polished spherical radius hole, in the part, that was used for support between centers . . . We designed a special STURDIMATIC LIVE CENTER which, revolving with the part, stopped all movement between the highly polished concentric surface and the center, eliminating the trouble at the source—without any rubbing action, the emery in the coolant had no bad effect . . . Scrap had been running high—threads had to be ground concentric with the spherical radius hole within very close tolerances and production of thousands per day had to be maintained. So here a substantial saving on a vital war part was accomplished by using a STURDIMATIC LIVE CENTER . . . standard shanks with Morse taper carried in stock . . . send for a catalog.

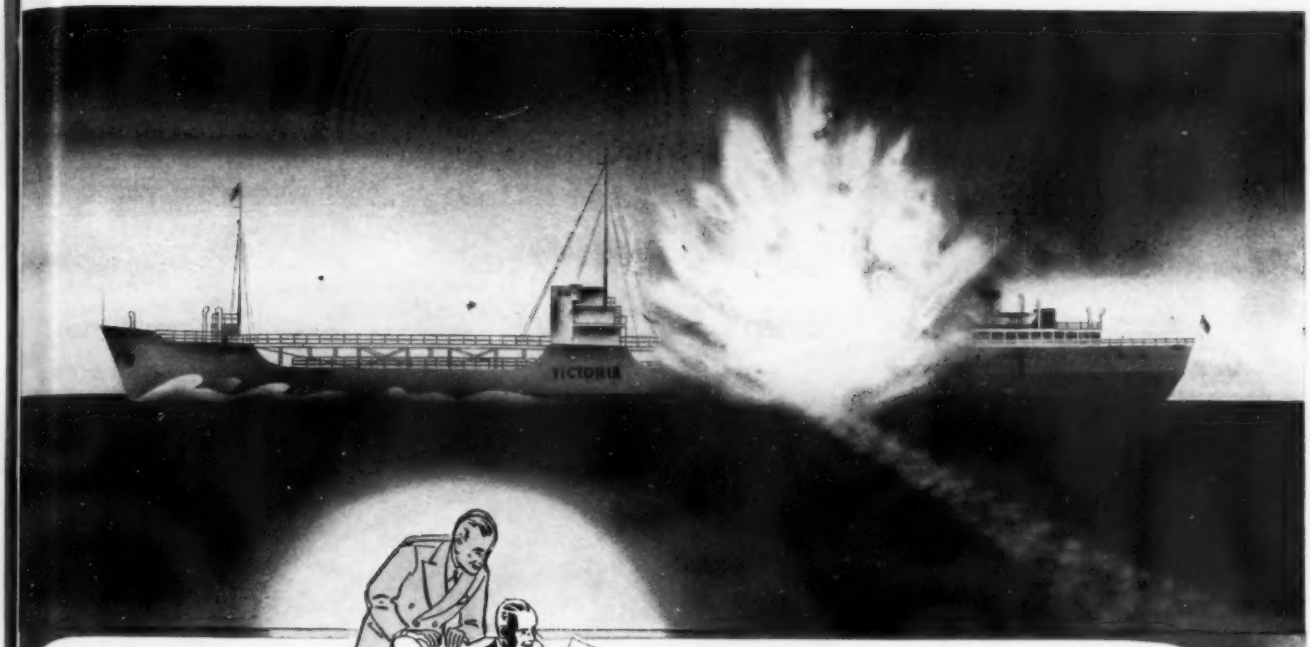
STURDIMATIC TOOL COMPANY
5214 Third Ave.
Detroit, Mich.
LIVE CENTERS

SHELDON BBU-1240 WQ
Precision Lathe

★ This quality 12 in. ball bearing tool room lathe is built for precision work and will retain its accuracy under long and hard usage. It has extra collet capacity (to 1" round), the finest precision ball or roller bearings obtainable, an improved heavy-duty, double wall apron with power cross feed; full quick change gears and full bowl headstock. Its improved Sheldon 4-speed, V-belt, lever-clutch operated, underneath motor drive is entirely enclosed in the pedestal leg and has anti-friction bearings. It is so designed that spindle belts operate thru a *standard* 1-piece bed. This bed is bridge-braced with heavy cross girts and has hand scraped ways—2 V-ways and 2 flat ways.

★ If interested in 10", 11" and 12" quality lathes be sure to see the SHELDON.

SHELDON MACHINE CO., INC.
4234 N. Knox Ave. Chicago, U.S.A.



then I said to myself—

So . . . the Nazis couldn't sink her!

This 12,500-ton, all-welded tanker "Victoria" was torpedoed amidships. Her deck plates buckled but her bulkheads held. Then, the baffled Nazis smashed a second torpedo into her and left, confident she was finished. But those welds refused to yield—even to Nazi TNT. She made it to port and was repaired—ready for the subs again. Some ship, I say!

Some construction, you mean! This is just one of many welded ships that have refused to be licked by torpedoes. Just like our welded M-4 tanks which withstood the Nazi 88's in North Africa. Ships, tanks, planes and guns—they're all welded for strength as well as for savings in time and materials.

Better products and *lower costs*—just what I want in my business after the war. Then why shouldn't I weld my peace-time products?

You should! You MUST if you plan to survive in the face of war-developed ideas. And believe me, your ship of business will sink or float, depending on how well you can stand up against competition on WELDING ECONOMY. Why not start NOW to learn from Lincoln the latest kinks in welding thrift.

THE LINCOLN ELECTRIC COMPANY, CLEVELAND, OHIO

C-F POSITIONERS

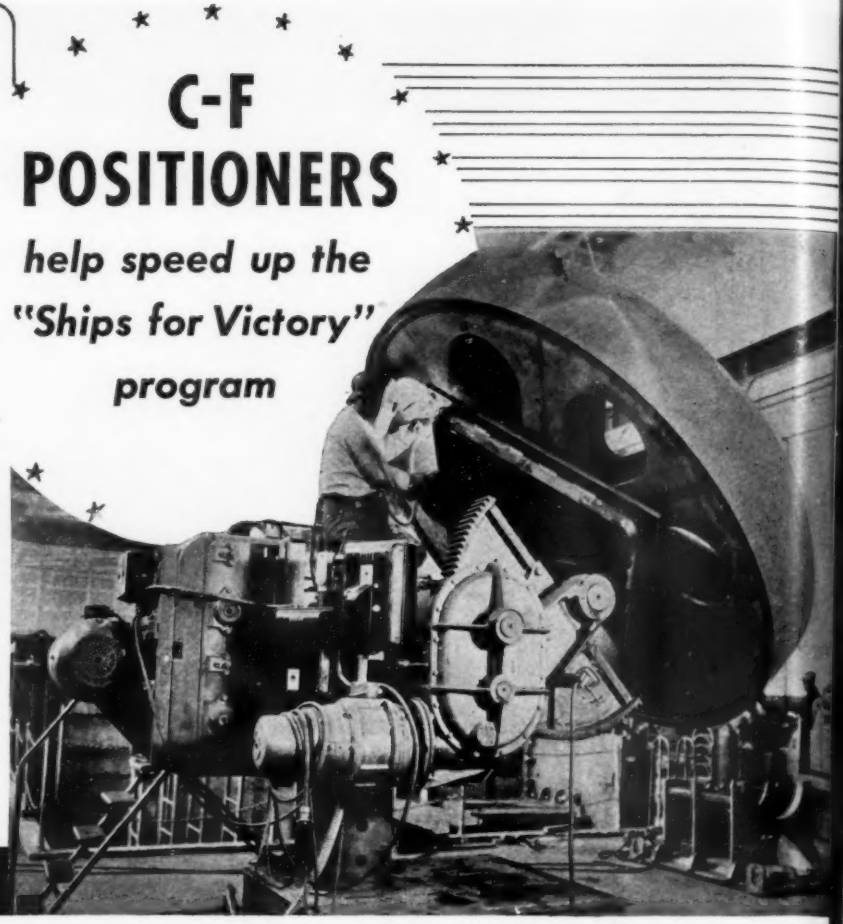
help speed up the "Ships for Victory" program

In numerous shipyards and unnumbered plants C-F POSITIONERS are making it possible to weld increasing numbers of parts and sub-assemblies on a production basis. Take the welder shown above who alone is welding a giant turbine gear blank—every angle and all sides and seams of it welded down-hand. This is possible because his No. 140 C-F POSITIONER tilts (to 135° beyond horizontal) and rotates (360°) this giant weldment at the push of a button. Moreover, the peripheral seams can be made in a single endless weld; for under a variable speed control the entire weldment passes under the rod at exactly the speed desired.

Among the great advances made in welding and welding technique has been the almost universal adoption of Positioned Welding. This has been made possible by C-F POSITIONERS which come in capacities of from 1,200 to 30,000 lbs., in types for every plant or shop.

Write for Bulletin WP 22.

CULLEN-FRIESTEDT CO.,
1333 S. KILBOURN AVE. CHICAGO, ILLINOIS



TWIN-MO
The new high speed steel

KINITE
Alloy Air Hardening Bar Steel & Castings

H. BOKER & CO., Inc., 101 Duane St., New York, N. Y.

ALADDIN ROD

Patent No. 2055360 NO FLUX NO ACIDS

DOES IT QUICKER, BETTER, MORE ECONOMICALLY
WELDS ZINC BASE DIE CAST and BRAZES ALUMINUM

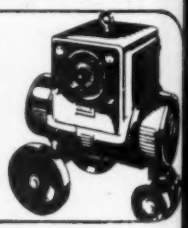
Repairs KIRKSITE and other zinc base dies, with die in either horizontal or perpendicular position. Unexcelled for use on sheet or cast aluminum, saves time and heat. Complete instructions with each pound. Sizes 1/16", 1/8", 3/16" & 1/4" also complete assorted lb. WRITE FOR FREE LITERATURE.

ALADDIN ROD & FLUX MFG. CO.
Box 935 Mad. Sq. Sta., Dept. G Grand Rapids, Mich.

Hobart

"Simplified" ARC WELDERS

America's successful production race was largely dependent on the world's greatest corner-cutting tool...arc welding. Hobarts have been the pace-setters: for you find them in small machine shops and million dollar industries the country over. They're speeding work, saving metals, making stronger tanks, planes, guns, trucks and ships.
Hobart Bros., Box 624, Troy, O.



"One of the World's Largest Builders of Arc Welders"

...WHERE YOU NEED LIGHT COLOR AND GOOD CUTTING QUALITY...

ALTHOUGH it is scientifically recognized that "dark color" sulphurized cutting oils are superior to "light color" oils for the tougher metal cutting operations, there are some classes of machining for which transparent cutting fluids may be used with satisfactory performance. Stuart's "SUPER-KOOL", the leading example of "light color" transparent sulphurized cutting oil, offers many unique and exclusive advantages. Order a trial drum and be convinced.

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Stuart's "SUPER-KOOL"
America's First Transparent Sulphurized Cutting Oil

For All Cutting Fluid Problems

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For the Most Efficient Speed . . .
. . . for each machine . . .
. . . for each operator . . .

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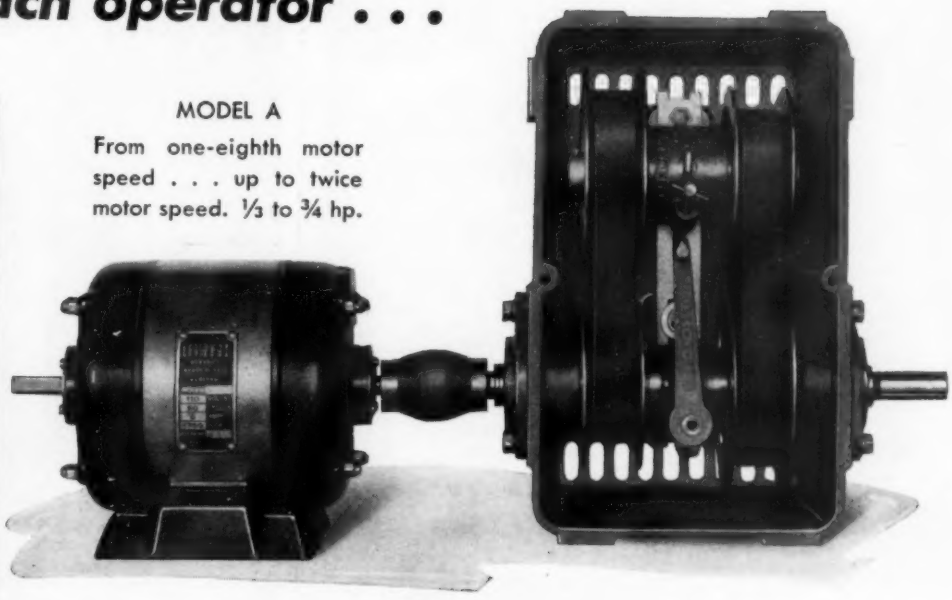
The WORTHINGTON ALLSPEED DRIVE FEATURES

- Single-unit construction . . . compact and strong
- 16 to 1 speed ratio . . . highest speed ratio in its price range
- Positive automatic belt tensioning . . . without springs
- Absolute assurance of smooth efficient operation
- Can be installed in any position . . . on any machine, new or old
- Can be used with any standard motor, 1725 to 1800 r. p. m.
- Operates in either direction . . . direct-connected to motor or through V-belt or flat-belt drive

MODEL A

From one-eighth motor speed . . . up to twice motor speed. ⅓ to ¾ hp.

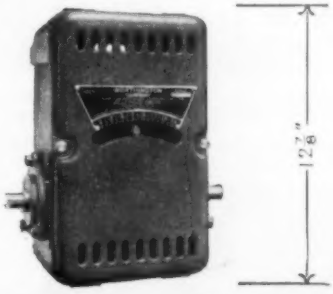


The WORTHINGTON ALLSPEED DRIVE

Reports from many plant engineers and time-study men show that their production has been stepped up 25% to 200% with this equipment. Another war-time value is the fact that it simplifies the training of machine operators . . . by permitting initial operation at low speeds, increasing the speed gradually as skill is acquired.

The advantages of such FINGER-TIP SPEED CONTROL are many and far-reaching. There are probably applications in *your* plant in which the Worthington Allspeed Drive could be used to advantage.

Write for literature . . . and ask the nearest Worthington office or dealer for a demonstration



MV3-6

WORTHINGTON

WORTHINGTON PUMP & MACHINERY CORPORATION • GENERAL OFFICES: HARRISON, N. J.

Is this YOUR Cleaning Problem?

PREPARING SURFACES FOR BLACK OXIDE COATINGS?

Quality of the black finish or coating you secure depends, to a significant degree, on the cleanliness of the metal surface with which you start. By FIRST getting this FREE FROM ALL smut, grease, oil and dirt . . . as you easily, quickly can by using Oakite materials . . . you will be certain of obtaining the satisfactory results you want!

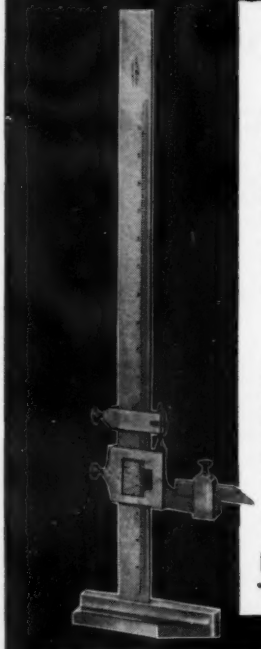
Because Oakite degreasing is THOROUGH, it assures a CHEMICALLY CLEAN surface on iron, steel, copper, zinc or brass. Result is a UNIFORM black finish with maximum adhering properties. Write for NEW 16-page FREE booklet giving details.

OAKITE PRODUCTS, INC., 24 Thames St., NEW YORK

Technical Service Representatives Conveniently Located in All Principal Cities of the United States and Canada

OAKITE Buy Bonds for Victory **CLEANING**

GUARANTEED PRECISION



McGrath St. Paul Height Gages

Manufactured to optical precision, McGrath St. Paul Height Gages are checked at each stage of production and furnished with a testing laboratory report on accuracy. They are manufactured in 10″, 18″, 24″ and 36″ sizes.

Speedy Delivery

Recently expanded manufacturing facilities allow us to guarantee reasonably quick deliveries of McGrath St. Paul Height Gages to priority purchasers. See your local distributor or write:

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McGRATH ST. PAUL CO., 7th AT KITTSON, ST. PAUL, MINN.

Other McGrath St. Paul tools include Vernier Height Gages • Vernier Calipers • Slide Calipers • Acme Screw Thread Gages • Telescoping Gages • Gear Tooth Calipers • Thread Micrometers • Micrometers • Spring Calipers • Glass Optical Flats • Glass Surface Plates.

STEVENS SCREW MACHINES

⅝ in. and 1⅛ in. Bar Capacities.

Simplified and Highly Efficient Motor Drive.

Write for bulletin.

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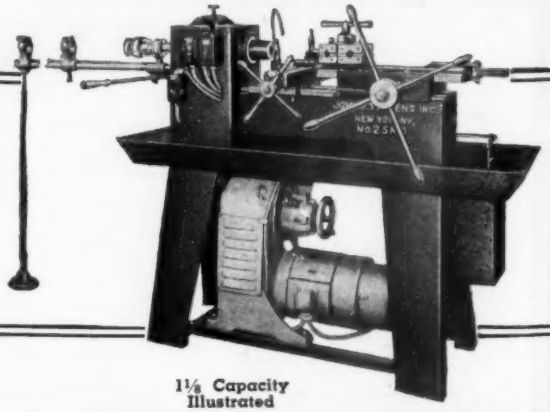
Also makers of Multiple Spindle Index Centers, Rotary Tables, Milling Machine Vises.

THIRTY YEARS' EXPERIENCE



1⅛ Capacity Illustrated

JOHN B. STEVENS INC.
474 Canal St., New York, N. Y.

BUZZER INDUSTRIAL *Gas* EQUIPMENT

'Reg U.S. Pat Off

No Blower or Power is needed to reach High Temperatures with a "BUZZER" Gas Furnace . . . just connect to your gas supply.

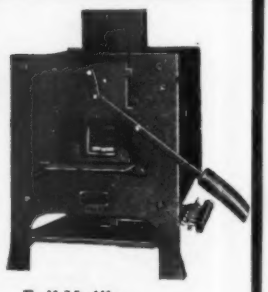
Rectangular Heat Baths

For liquid heat treating baths, soft metal melting, etc.

The High Speed Full Muffle Furnace attains a temperature of 2400° F., and is designed for High Carbon and Alloy Steels.

BUZZER Rectangular Heat Baths meet the increasing demands for large liquid Heat Bath Furnaces, and are built in many sizes. Also made in round type pot furnaces

Send for the new BUZZER Catalog showing full line of Gas Furnaces, Burners and other equipment.



Full Muffle Furnace (Bench Type)

CHARLES A. HONES, INC.
121 South Grand Avenue Baldwin, L. I., N. Y.

Machining today's swords AND TOMORROW'S PLOWSHARES

Accurate machining of large irregular contours, be they armament products or peacetime ship propellers, has always presented a difficult problem. Such castings usually require hand finishing, chipping and grinding, or some alternate laborious process. Not only are valuable man-hours tied up —but the finished workpiece, more often than not, deviates from the tolerances specified for the theoretically correct contour.

Standard milling machines are limited in the size of workpiece they will accommodate, and duplicating machines have much the same limitations.

A Westinghouse-developed device for more accurate firing of guns in motion provided the solution to the problem. Using the principles of this device, an electrically-controlled tracer mechanism follows the contours of a scale-model jig and guides the contour milling machine cutters on the workpiece surfaces. The model may be accurately formed of wood, plastic, metal or any other material. Thus, large irregular surfaces may be reproduced in any desired quantity, working within tolerances of a few thousandths, and in a fraction of the time required for the less accurate hand methods.

THE MACHINE IN MACHINE TOOLS

Westinghouse engineers often are called upon to supply electrical solutions to the complex mechanical problems of the nation's leading machine tool builders. This consulting service is yours for the asking. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. J-94572

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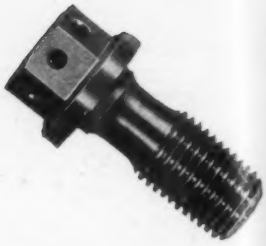
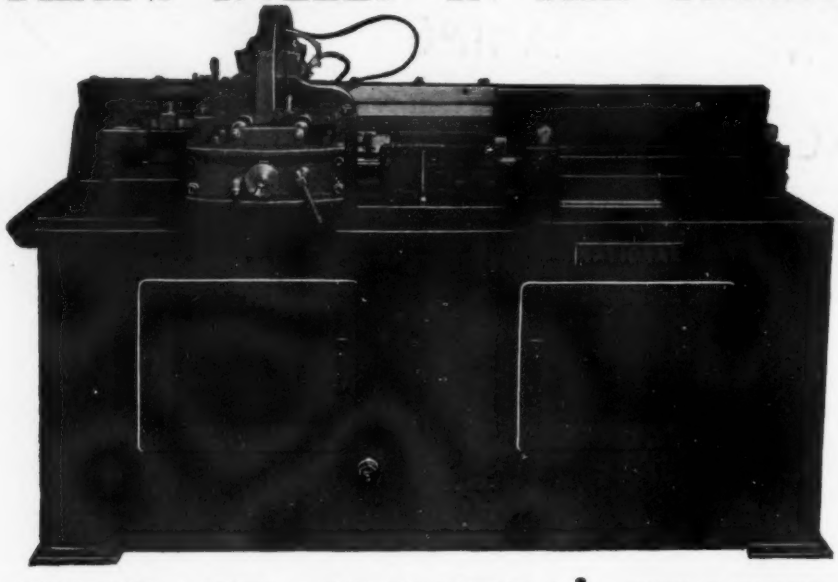
PLANTS IN 25 CITIES OFFICES EVERYWHERE

It's NATIONAL Engineering



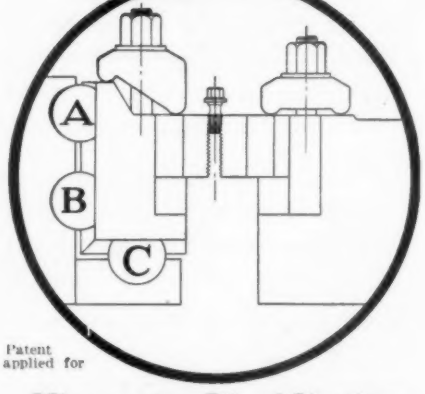
THAT'S ROLLED IN THE THREAD



MEETS AIRCRAFT BUILDERS' REQUIREMENTS.

Now in production on various Aircraft parts we wish to announce to Producers of all Precision threaded parts, a new NATIONAL FULL HYDRAULIC PRECISION THREAD ROLLER — employing principles entirely new to an old art. The hydraulic controlled reciprocating ram for the moving die, and the other engineering features of the machine provide accurate cold working of thread, maintaining the most consistent production at most exacting tolerances.

For more detailed information write the factory.



Patent applied for

Micrometer Die Adjusting Arrangement

By micrometer adjustment of wedges A and B the parallel or out of parallel alignment of die faces can be perfectly controlled. Also adjustment of wedge C corrects for elevation alignment of dies.

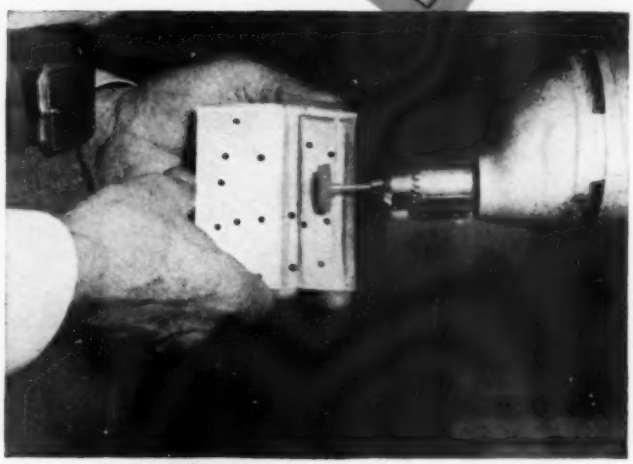
Also Manufacturers of
SPOT, PRESS, SEAM, BUTT, FLASH AND SPECIAL WELDING MACHINES

NATIONAL ELECTRIC WELDING MACHINES CO.
BAY CITY, MICH., U. S. A.

Write for Brightboy's "Methods and Applications" Data THAT IS *simplifying and speeding up* DE-BURRING ★ CLEANING FINISHING ★ POLISHING

THE special characteristics of Brightboy's rubber cushioned abrasive action have opened up limitless time and work saving possibilities in the field of metal finishing. And new Brightboy machine and manual applications, uncovered in the pressure of wartime production, are being reported daily.

In this comprehensive Brightboy literature you will find data showing how Brightboy bridges the gap between a grind and a buff, *giving a finish which frequently serves as a final polish* —a finish achieved with minimum dimensional loss! Write us if your dealer does not have this literature—or for suggestions with regard to your own production problems. Ask to have one of our service representatives call.



De-burring — finishing holes and edges in Alclad part.

Available in 3 Textures

BRIGHTBOY STANDARD
for all-around metal finishing.
BRIGHTBOY FINE-TEX
for lighter work—for fine polishing.
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for harder metals.

WHEELS
STICKS
RODS
TABLETS

The Soft Rubber Binder Cushions The Abrasive

BRIGHTBOY INDUSTRIAL DIVISION
WELDON ROBERTS RUBBER CO.
Newark, N. J.

WELDON ROBERTS Brightboy

REG. U.S. PAT. OFF.

EVEN A MINOR CASE OF LOST-TIME EYES

costs far more than any pair of AO Safety Goggles

When one of your workmen suffers a minor eye injury, here's a typical picture of what happens: He stops work and goes to the First-Aid station for treatment. Usually he is sent home to nurse his injury. Next day he returns to work and has two brief treatments at the First-Aid room.

Now, let's estimate costs. First, the workman suffers pain and annoyance. He loses 3 or 4 hours' pay. Your company's expenses include items such as these:

Machine idle for 3 or 4 hours . . . First Aid . . . Treatment Medical Supplies . . . Foreman's time on case . . .

Now, compare these costs with the price of a pair of comfortable AO safety goggles. You'll find that even a *minor* eye accident is now costing you two, three, five, maybe *ten* times as much as a pair of AO Safety Goggles designed to prevent eye accidents from happening.

Make sure that your workers have AO eye protection. For information, advice and full cooperation, get in touch with the nearest AO branch—there's one in every principal industrial center throughout the United States and Canada —or have an AO representative call at your office.

American Optical

COMPANY

SOUTHBRIDGE, MASSACHUSETTS

Courtesy Bell Aircraft Corp.

Tips on finishing transparent plastics

THE aircraft manufacturing industries face special problems today in the finishing of transparent plastics. Therefore, an understanding of the abrasive products and methods of use best suited to their solution is important.

The picture above shows a process employed by Bell Aircraft Corporation using a Carborundum Brand Silicon Carbide cloth sleeve to finish the edges of enclosure sections for Airacobra cockpits. Abrasive discs, sleeves, belts and sheets are all widely used throughout the aircraft industry to meet the various finishing conditions encountered.

For best results in most edging operations, sanders should be operated at about 3,000 feet per minute. In general it is better to use a wet sanding process than a dry, in order to reduce heat, settle dust, eliminate loading of the abrasive surface, speed cutting and increase abrasive life. For surface finishing it is well to select as fine an abrasive as possible. One just fine enough to remove any scratches left by the previous operation is usually the right choice. This is a typical example of an operation employed on one of the newer materials of construction. In metal finishing operations, Aloxite Brand Aluminum Oxide in its various forms—discs, sleeves, belts and sheets—is used extensively.

Whatever may be your use of abrasives, we ask you to remember one thing: every abrasive tool is a "Weapon for Production"; it's important to use it wisely.

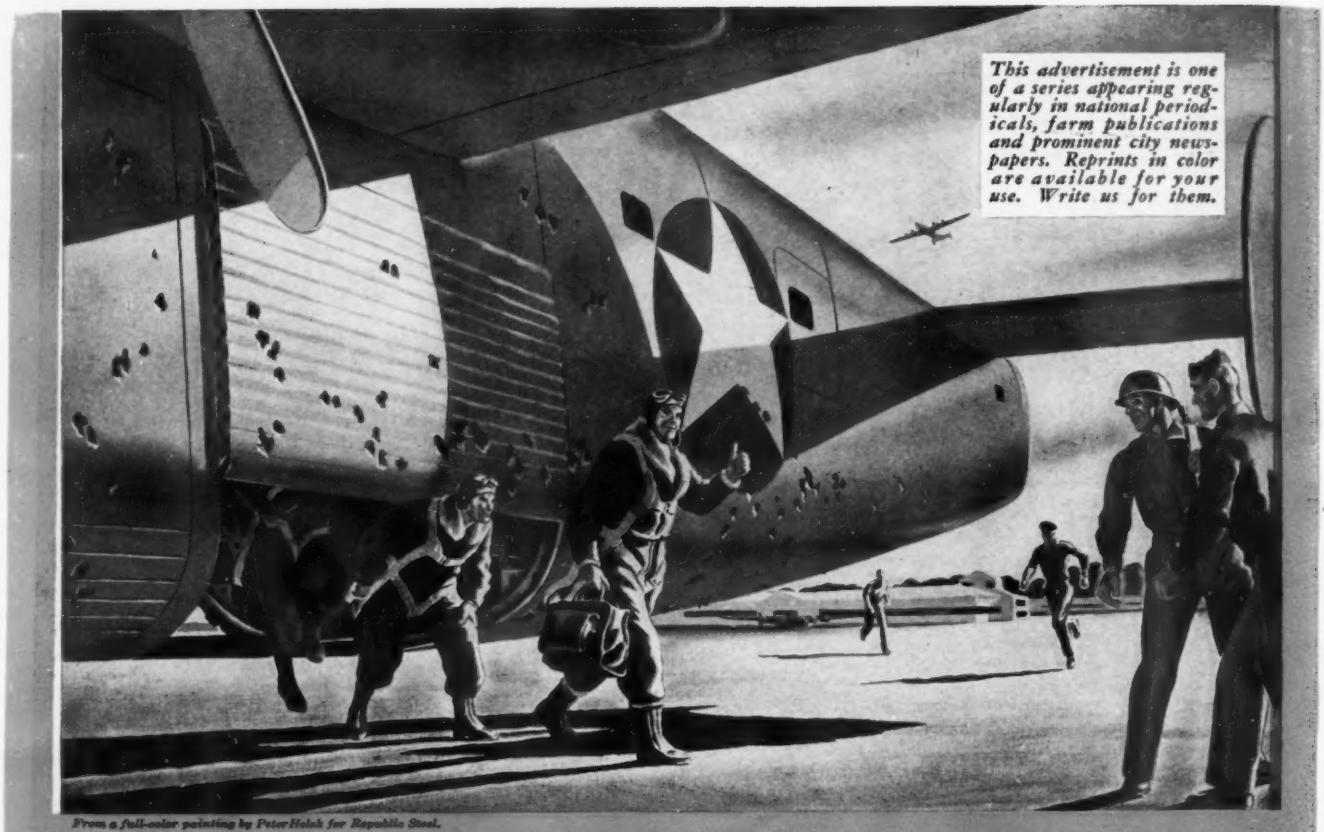
CARBORUNDUM
REG. U.S. PAT. OFF.
ABRASIVE PRODUCTS

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.
REG. U. S. PAT. OFF.

MANUFACTURERS OF GRINDING WHEELS, COATED ABRASIVES, SUPER REFRACTORIES, HEATING ELEMENTS

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

(Carborundum and Aloxite are registered trade-marks of and indicate manufacture by The Carborundum Company)



This advertisement is one of a series appearing regularly in national periodicals, farm publications and prominent city newspapers. Reprints in color are available for your use. Write us for them.

From a full-color painting by Peter Helck for Republic Steel.

BELLY FULL OF BULLETS—but every man alive!

...Tex., reported not one man of the 10 aboard the bomber received as much as a scratch. One of the bomber's engines was shot up, however, and there were bullet holes in the fuselage. It was this bomber's first encounter with Jap Zeros. The plane crew includ...

(clipped from a recent issue of the Cleveland Plain Dealer)

Unusual news? Once it was, but not today! Items like this are appearing almost every day—telling of the miraculous ability of American bombers to reach their objectives through a deadly hail of enemy fire—and return with every man alive.

★ ★ ★

American planes are proving their fighting ability in the skies over most of the globe. They can take it as well as dish it out.

Scores of American flyers in all parts of the world owe their lives to armor plate at vital points in planes—armor plate *tough* enough to stop enemy bullets and *light enough to fly* high.

The quality of these planes is a tribute to the American system of industry. The volume of their production is amazing—from 20,000 in 1941 up to 49,000 in 1942—more planes than we produced in the 23 years preceding this war.

This production job would not have been possible without vastly increased tonnages of the fine steels necessary for engines, fuselages, propellers, landing gear, armor and armament.

Free American industry has done a far greater war production job in two years than Hitler's "efficient dictatorship" could do in *ten* years! And not because we are a race of supermen, but because we are *FREE* men.

In these same two years, Republic's electric furnace capacity for making "Aircraft Quality" steels, light armor plate and other fine alloy steels increased more than 700%. Output of steel plates for ships was boosted 500%. A huge stream of peacetime products was diverted into a record-breaking flood of war steels and steel products.

Until we win the victory that will insure our American way of life—freedom to live as we choose, to speak, worship and work without fear or want—Republic will continue its "full-out" war effort.

After that, Republic will utilize its past experience, enlarged facilities and new knowledge gained in wartime production and in increasing research to provide more steel, finer steels to further enhance what we have always thought was the best Country in which to live.

You and we owe it to our sons and brothers in uniform that they shall return to an America that is worth their sacrifices—an America that will grow even greater and stronger because it is *FREE*. Let's see to it that our job is done—*WELL!*

REPUBLIC STEEL CORPORATION

General Offices: Cleveland, Ohio

Berger Manufacturing Division • Culvert Division
Niles Steel Products Division • Steel and Tubes Division
Union Drawn Steel Division • Truscon Steel Company
Export Department: Chrysler Building, New York, N. Y.

Republic

ALLOY AND ENDURO STAINLESS STEELS

Sheets—Plates—Hot Rolled and Cold Drawn Bars—
Pipe—Upson Bolts, Nuts, Rivets—Electrunite Tubing

Here at last . . . the answer to Corrosion Problems

ANTI-CORRODE

New Liquid Safeguard Developed by Cities Service

Anti-Corrode, Proved Perfect by Months of Laboratory Testing, Meets Severest Corrosion Requirements. It's Easy, Economical to Apply.

After months of laboratory research and rigorous service tests, Cities Service takes pride in announcing the development of a new and *completely effective* corrosion preventive—Anti-Corrode.

This new liquid safeguard, by virtue of its special properties, and its reasonable cost, is hailed by many engineers as a perfect answer to the vital problem of metal conservation that American industry faces today.

METHODS OF APPLICATION

Anti-Corrode can be applied to raw stocks, finished parts, or to complete machines during storage, assembling or shipping. It is easily applied by dipping, brushing, rubbing, hand or power spraying—and provides a safe film which does not harden, become brittle or crack.

WEATHERING

Anti-Corrode is not affected by rain, salt air, oxygen bearing moisture, etc.

ODOR

Anti-Corrode has no disagreeable odor.

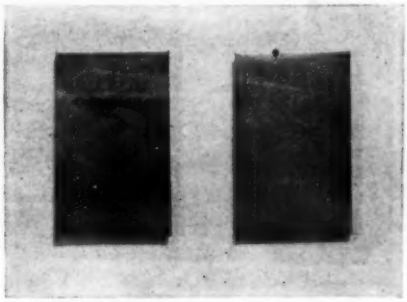
CHEMICALLY INERT

Anti-Corrode is chemically inert to ferrous or non-ferrous metals. Therefore, it can cause no injury to any metal to which it is applied or with which it may be brought in contact.

FINGER STAINS

Surfaces coated with Anti-Corrode can be handled freely without danger of rust spots caused by hand acid.

ANTI-CORRODE MEETS U. S. NAVY TEST



BOTH STRIPS of freshly ground steel pictured here were immersed for 20 hours in a 3% salt solution. Strip on left was untreated; strip on right, coated with Anti-Corrode, shows no trace of rust. (Even after 90 hours of immersion Anti-Corrode coating still resisted rust.)

A LUBRICANT, TOO

Anti-Corrode is compatible with drawing compounds; there is no need to remove it from metal about to be drawn, stamped or otherwise formed.

IDEAL FOR MANY USES

Anti-Corrode can be used on almost every kind of metal or metal equipment—*indoors or outdoors*. Fencing, piping, tubing, wire, wire mesh, girders, sheet metal, metal stock, machinery, trucks, spare automotive parts, tools, metal containers—all need the protection of this new corrosion preventive.

ECONOMICAL

In accordance with regular U. S. Navy Test procedure, Anti-Corrode proved far superior to other leading anti-rust compounds costing as much as *25% to 40% more per gallon.*

Whatever metal equipment you may have, you owe it to yourself to investigate the money-saving advantages of Cities Service Anti-Corrode. (One gallon of Anti-Corrode protects approximately 1200 square feet of sheet metal.) Send the coupon below for further information on how to obtain an adequate sample of Anti-Corrode FREE.

CITIES SERVICE OIL COMPANY
Room 1634,
Sixty Wall Tower, New York.

Gentlemen: I'd like to test Anti-Corrode on my own equipment FREE OF CHARGE. Send me the details.

Name .....

Title .....

Company .....

Address .....

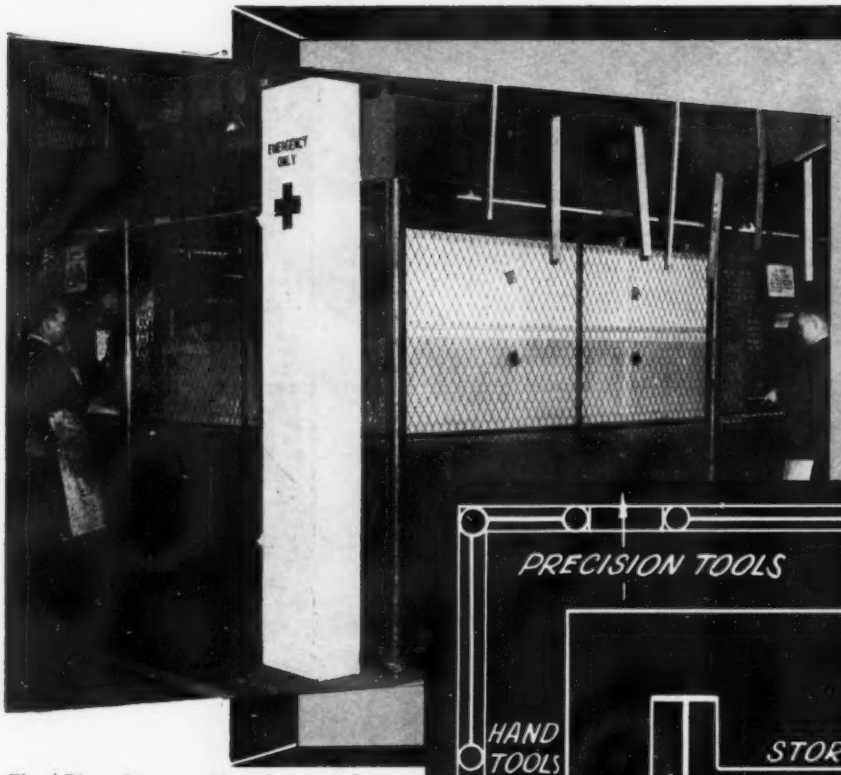
OIL IS AMMUNITION—USE IT WISELY!

CITIES SERVICE OILS — ONCE-ALWAYS

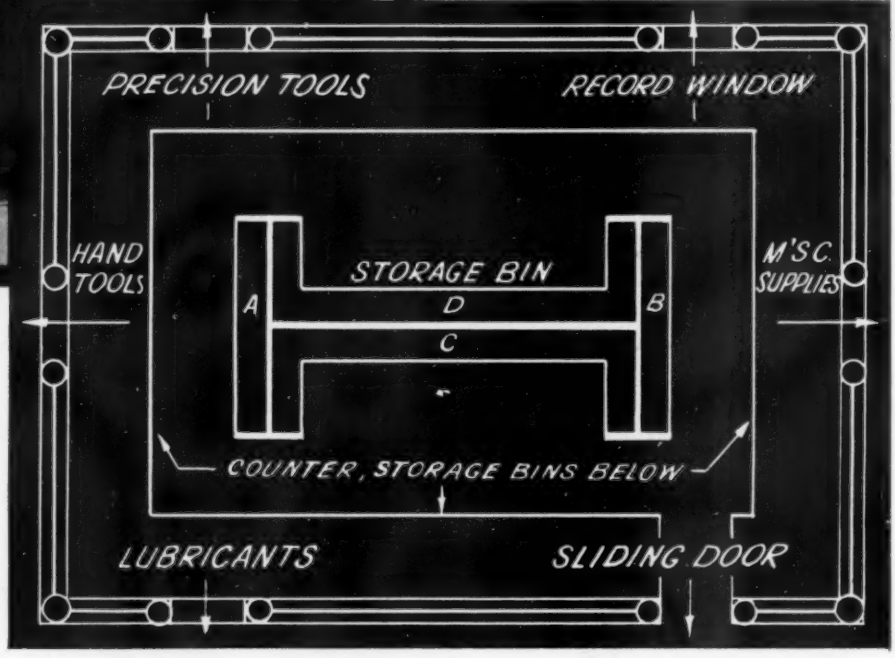
CITIES SERVICE OIL COMPANY
NEW YORK · CHICAGO

IN THE SOUTH
ARKANSAS FUEL OIL COMPANY
SHREVEPORT, LA.

More Windows IN YOUR TOOL CRIB



This photograph shows 2 of the 5 windows in the Tool Crib of the Jig Shop at Republic Aviation Corp., Farmingdale, N. Y., plan of which is shown below.



Floor Plan. Storage bins for articles served at each window are under delivery counter. Note "record window," used for starting employees, assigning checks, releases, transfers.

Suggested Plan for Reserve Storage Bin

"A" *Hand Tools:* Drills, rivet sets, counterbores, mallets, files, etc.

"B" *Supplies:* Emery and sand paper, tapes, gloves, towels, etc.

"C" *Containers:* For carbon tet., kerosene, mineral spirits.

"D" *Precision tools:* Height gages, levels, transits, calipers, micrometers, angle plates, etc.

LESS *Waiting Time* FOR YOUR MEN

HERE's a tool crib with five windows — one for every class of tools and supplies. It's big, but the management finds that it pays big returns — by reducing waiting time for men and "down" time for machines.

Your layout may not need to be so elaborate; but careful planning of your tool crib to assure free movement and systematic order always results in longer life and more effective use of your tools.

GTD GREENFIELD

TAPS · · · DIES · · · GAGES · · · TWIST DRILLS · · · SCREW PLATES

ARMY E NAVY

GREENFIELD TAP AND DIE CORPORATION

GREENFIELD, MASSACHUSETTS

DETROIT PLANT: 5850 Second Blvd.

WAREHOUSES in New York, Chicago, and Los Angeles

In Canada: GREENFIELD TAP AND DIE CORP. OF CANADA, LTD., GALT, ONT.

Tool Conservation Begins in the Tool Crib

HOW AND WHY

WILLIAMS' TOOLS AID WAR PRODUCTION

USE OF WILLIAMS' THREADING TOOL HOLDERS

Thread cutting in the engine lathe is one of the most exacting lathe operations, and one which requires a thorough knowledge of change gear principles and procedure. However, the accuracy and quality of the final job depends upon the cutting tool itself. An explanation of the proper application of two types of Williams' Threading Tool Holders follows:

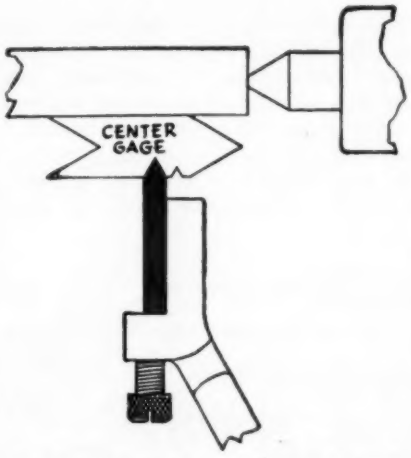
EXTERNAL THREADING WITH WILLIAMS' LOCKABLE SPRING-HEAD HOLDER

Made in 3 sizes for cutters 1/4", 5/16" and 3/8" square.

This tool is designed for both fine and coarse threading. Its Spring Head is equipped with a Locking Nut which provides the rigid backing required for heavy cuts; when loosened, the Holder becomes a Spring Tool for finishing work. Finished High Speed Steel cutters are furnished with this tool having each end ground to a "V" point forming an angle of 60°.

To set the Tool, first adjust the cutter so that only the ground portion projects beyond the holder. Now set the Holder in the Tool Post, adjusting the cutter point vertically to exact center of the work. Then place

a Center Gage with its back edge in contact with the work, or the Tailstock Spindle, and adjust the Tool horizontally by fitting the cutter point *exactly* into the 60° angle notch in the front edge of the Center Gage (see illustration). Tighten the Tool Post Screw, using caution not to change position of the Holder. Apply cutting oil to the work generously when threading steel.



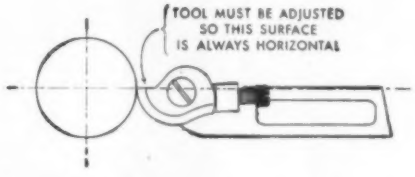
Application of Threading Tool. Center Gage must be held parallel to the machine bed ways when setting tool.

EXTERNAL THREADING WITH WILLIAMS' FORMED-CUTTER HOLDER

Made in 4 sizes, with formed cutters 5/16" to 5/8" thick.

The High Speed Steel Formed Cutter with which this tool is equipped is ground to an included angle of 60° and is backed off for correct clearance. In regrinding, the top edge only is ground, thus assuring a point of proper form and angle as originally supplied.

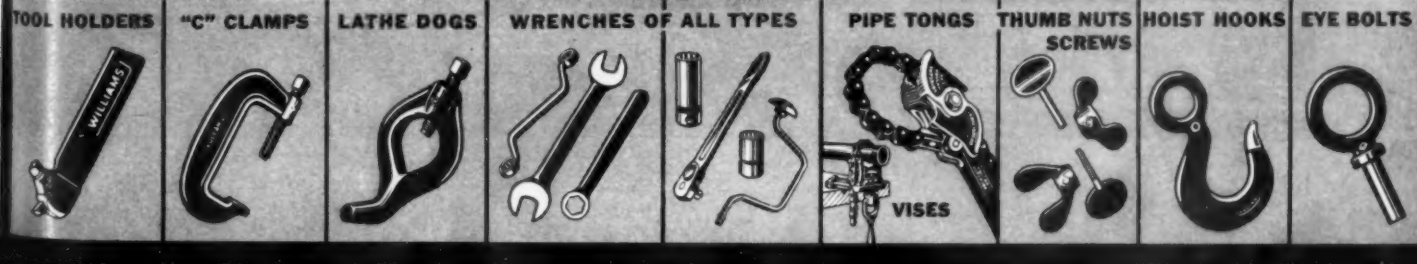
Procedure in setting this tool is the same as explained for the Spring Head Tool. In adjusting height of Tool so as to center on the work, do not use the Stop Screw on the side of Holder. This adjustment is used to compensate for metal removed from the cutting point in regrinding. The top surface of the cutting point must always be horizontal when threading (see illustration).



Internal threading with Williams' Tools will be discussed in our next advertisement. Reprints of this and the thirteen preceding factual data sheets of this series are available, at no charge, either for bulletin board use or punched for 3-ring binder.

WILLIAMS
SUPERIOR DROP-FORGED TOOLS
Headquarters for over half a century for DROP-FORGINGS and DROP-FORGED TOOLS

Sold by Leading Industrial Distributors Everywhere . . . J. H. Williams & Co., Buffalo, N. Y.



"Don't Fire 'Til You See The Whites Of Their Eyes"

Bunker Hill; June 17, 1775

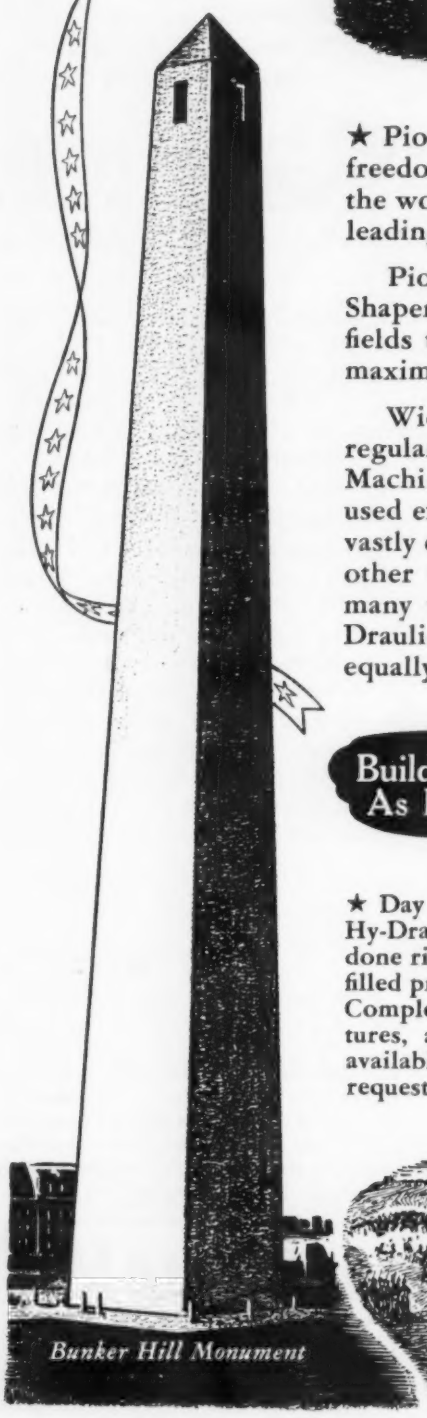
★ Pioneer Americans at Bunker Hill hit hard and accurately for freedom with everything they had. Today Americans throughout the world are doing likewise, for the same cause, with all of the leading means and methods of modern military science.

Pioneers in the use of hydraulic drives and feeds; Hy-Draulic Shapers, Planers, Slotters and Shaper-Planers are leaders in their fields today. Their exclusive features and advantages promote maximum production with minimum operating effort.

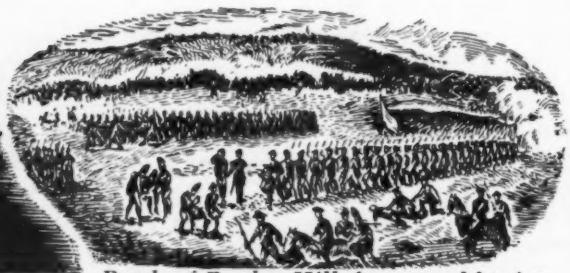
Widely used in commercial manufacturing and maintenance, regularly supplied to Army and Navy in peace-time; Hy-Draulic Machine Tools are urgently demanded in time of war. They are used extensively by industries converting to war work, and on a vastly expanded scale in manufacturing ordnance, projectiles and other war material. They are helping the United Nations, in many ways, to hit hard; to win the victory. These same Hy-Draulic Shapers, Planers, Slotters and Shaper-Planers will be equally useful and productive in the peace that follows.

Building *Hy-Draulic* Machine Tools As Fast As It Can Be Done Right

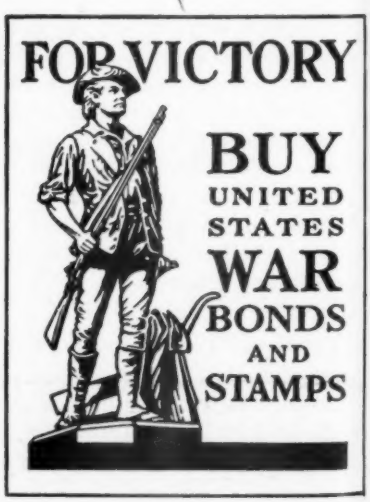
★ Day and night, willing hands are building Hy-Draulic Machine Tools as fast as it can be done right so that orders received *now* can be filled promptly according to official priorities. Complete information about Hy-Draulic features, advantages, specifications, prices and available deliveries supplied promptly on request. Write for bulletins, *today.*



Bunker Hill Monument



Battle of Bunker Hill, from an old print



Hy-Draulic
Reg. U. S. Pat. Off.

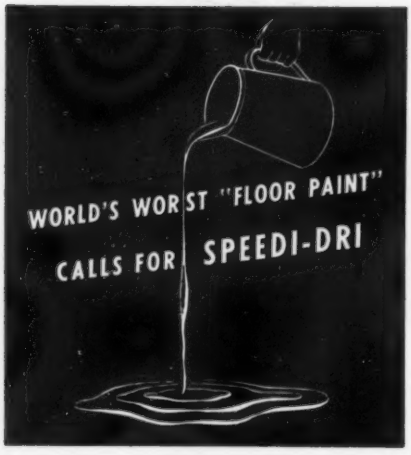
Shapers..Planers..Slotters..Shaper-Planers

ROCKFORD MACHINE TOOL CO.

ROCKFORD, ILLINOIS, U.S.A.

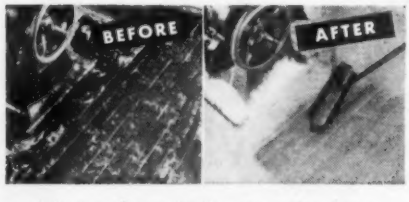
This Absenteeism poster is a nugget from the Reliance suggestion box.

RELIANCE ELECTRIC & ENGINEERING CO.
IVANHOE ROAD • CLEVELAND, OHIO
ELECTRIC MOTORS, MOTOR-GENERATOR SETS, SPECIAL POWER EQUIPMENT



If you're carelessly "painting" the floor of your plant with inflammable, slippery oil, you need Speedi-Dri. Take a walk through the shop. Notice the condition of the floor around the machines. Can you *possibly* overlook the danger of your employes slipping in that oily mess? *Think* what a carelessly dropped match or cigarette might do!

Speedi-Dri soaks up grease and oil like a sponge, sets up an immediate skid-proof surface and blankets the hazard of flash fires. So great is its affinity for oils that, in time, it will pull old deposits right out of the floor, restoring the original appearance. Speedi-Dri saves workmen's shoes from oil-rot, minimizing the danger of foot infections. Easily and quickly spread by hand, it conserves vital manpower. No matter what you are now using, Speedi-Dri can do the job better, faster, cheaper. Prove it by testing Speedi-Dri in your own shop. (Where water is present or water soluble oils are used, ask for Sol-Speedi-Dri.) Prompt service from warehouse stocks in leading cities.



Ask for demonstration or write for a generous free sample of Speedi-Dri.

SPEEDI-DRI
OIL AND GREASE ABSORBENT

SUPPLIERS

East — **REFINERS LUBRICATING CO.**
New York City

Midwest and South
WAVERLY PETROLEUM PRODUCTS CO.
Philadelphia, Pa.

West Coast
WAVERLY PETROLEUM PRODUCTS CO.
Menlo Park, Calif.

DUE TO WAREHOUSE SERVICE!

A tank factory needed steel shafts in fifteen days! Bissett accepted this order . . . and beat the promise. To us, the war is no excuse for curtailed service, but a mighty challenge to our facilities for increased service. Perhaps a similar problem in your plant can be solved by Bissett engineers.

BUY WAR BONDS!

NORMALLY CARRIED IN STOCK

N.E. Steels and Standard S.A.E. Steels, both Carbon and Alloy, Hot Rolled and Cold Drawn • Chisel Steels • Cumberland Ground Shafts • Drill Rod • High Speed Tool Bits • Shim Steels • Tool Steels • Tool Steel Tubing • Boiler Tubing

the BISSETT steel company

DIRECT MILL REPRESENTATIVES SINCE 1920

MAIN OFFICE & WAREHOUSE
947 E. 67TH ST. • CLEVELAND
TELEPHONE HENDERSON 0993

16 Pages of...

BASIC INFORMATION

To Help Speed Employee Training

• Production executives are using "The Tools of Our Trade," 16-page special section reprinted from *American Machinist*, to help reduce instruction time of new employees. Information contained covers measuring, gaging, marking, holding, cutting, forming and milling tools—just the kind of information a novice needs to get started in the shop. Basic data in compact form which will save you months of compilation time.

MAIL COUPON TODAY

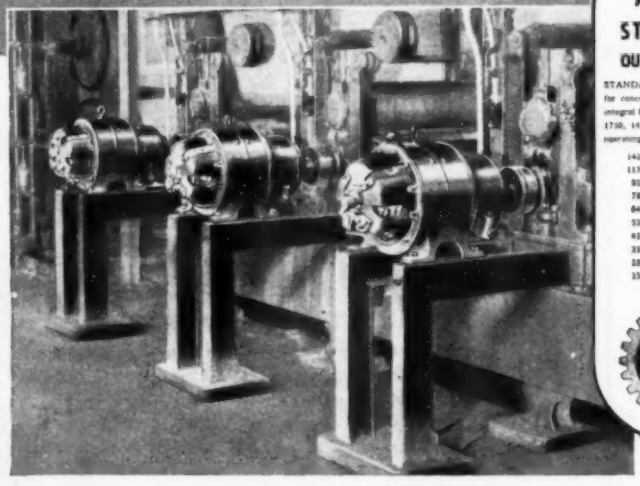
AMERICAN MACHINIST
330 W. 42 St., New York, N.Y.

Price **10¢** per copy in quantities over 10 (Less than 10, free)

AMERICAN MACHINIST
330 W. 42nd St., New York, N. Y. .
Kindly send me ..... copies of "The Tools of Our Trade" (No. 1) for which I enclose $..... (in stamps, money order, check)

Name .....
Title .....
Company .....
Address .....

for *LINE DRIVES* or *DIRECT CONNECTED DRIVES* make your choice Philadelphia MOTOREDUCER



★
A.G.M.A. STANDARD OUTPUT SPEEDS

STANDARD OUTPUT SPEEDS for concentric and parallel shaft integral hp Gearmotors. Based on 1750, 1450 or 1165 rpm motor operating speeds.

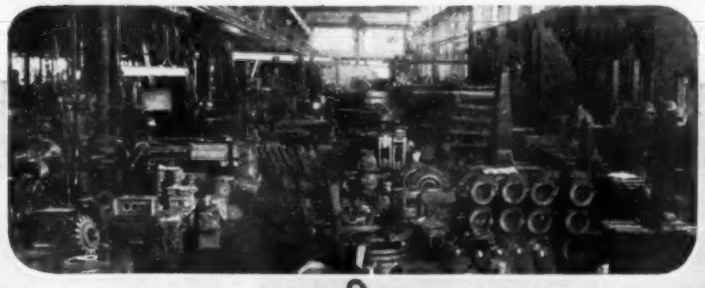
1450	190	28
1170	155	20
950	125	16.5
780	100	13.5
640	84	11.0
530	68	9.0
420	56	7.5
350	45	6.0
280	37	5.0
230	30	4.0

AGMA

The compact design of the Philadelphia MotoReduceR with its motor and speed reducer in a single housing greatly simplifies installation, and makes it an ideal choice for service where other types of drives are impractical. Furthermore, its rugged construction assures dependable, trouble-free performance with little attention. This has been proven by the countless units in service in all kinds of industrial plants during the past decade. Philadelphia MotoReduceRs are made in both horizontal and vertical types, in a wide range of horsepowers and ratios, with practically any available motor construction. Get our catalog MR 40 for details.

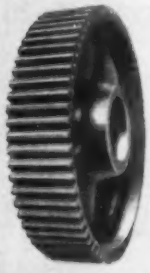
PHILADELPHIA GEAR WORKS

INDUSTRIAL GEARS
AND SPEED REDUCERS
LIMITORQUE VALVE CONTROLS



ERIE AVENUE & G STREET
PHILADELPHIA, PA.
New York, Pittsburgh, Chicago

Philadelphia **LIMITORQUE CONTROL** operates all types of valves, etc., safely, economically, from convenient stations.

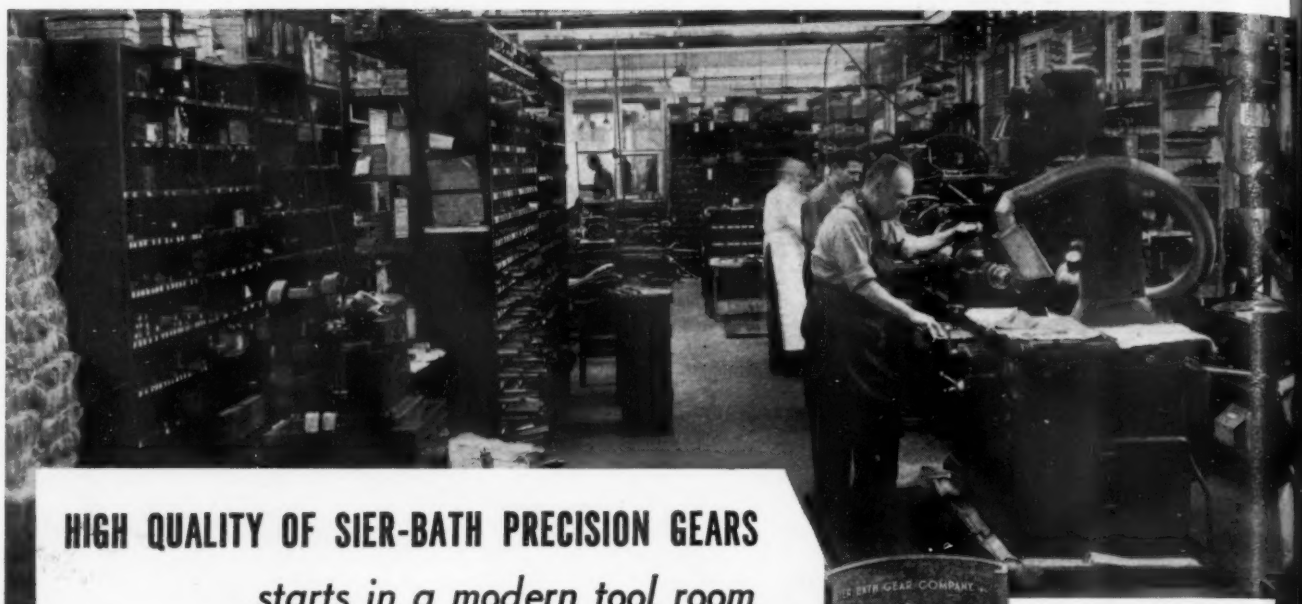


Philadelphia **GEARS** All types and sizes of industrial gears. Can be supplied in all materials.

Philadelphia **HERRINGBONE SPEED REDUCER** for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.

Philadelphia **MOTOREDUCER** The economical self-contained drive, Horizontal or Vertical types — various ratios and horsepowers.

Philadelphia **WORM GEAR SPEED REDUCER** right angle drives — vertical or horizontal. Wide range of ratios and horsepowers.



HIGH QUALITY OF SIER-BATH PRECISION GEARS

starts in a modern tool room

Equipped with every modern facility for tool maintenance essential to precision gear production, the Sier-Bath Tool Room is a model for completeness, accuracy and efficiency. It is operated, controlled and supervised by men of long specialized experience. The high standards set in this important department are maintained through every production operation, because Sier-Bath well recognizes the importance of good tools for producing high quality gears.

Sier-Bath is tooled for producing all types of gears from 2" to 52" diameter —promptly to your requirements on high priority.

The Doorway to 38 years experience in making Precision Gears

SIER-BATH GEAR CO.
NORTH BERGEN NEW JERSEY
Incorporated

GEAR CUTTING MACHINES

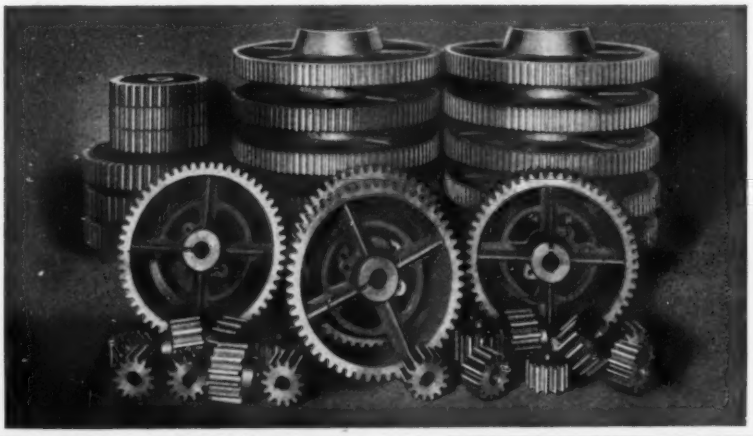
New Design
New Features
New Advantages

NEWARK GEAR CUTTING MACHINE CO.
69 Prospect Street, NEWARK, NEW JERSEY

SPECIALISTS...
not jacks of all trades!

To do one thing *perfectly* rather than many things well is the sole objective of every MEISEL gear. And being constructed with only the requirements of a specific job in mind, MEISEL gears function at maximum efficiency always. Whatever your gear problem, investigate the advantages of *specifically* engineered gear by MEISEL.

MEISEL PRESS MFG. CO.
946 Dorchester Avenue Boston, Mass.



ADAMS GEARS

SPUR — HELICAL — WORMS
BEVEL — MITER — RACKS

Splined Shafts a Specialty

THE ADAMS COMPANY
Est. 1883
1942 Bridge St. Dubuque, Iowa

MADE...
...to your requirements
We design and cut bevel, spur, ring, miter, worm, herringbone and other types of gears for every branch of industry. Sizes range from ½" up to many feet in diameter and materials include both ferrous and non-ferrous alloys. Write today for the Earle Gear Booklet 42-G which contains full, detailed information.
THE EARLE GEAR & MACHINE CO.
4723 Stenton Avenue, Philadelphia, Pa.
EARLE GEARS

Gear Specialties

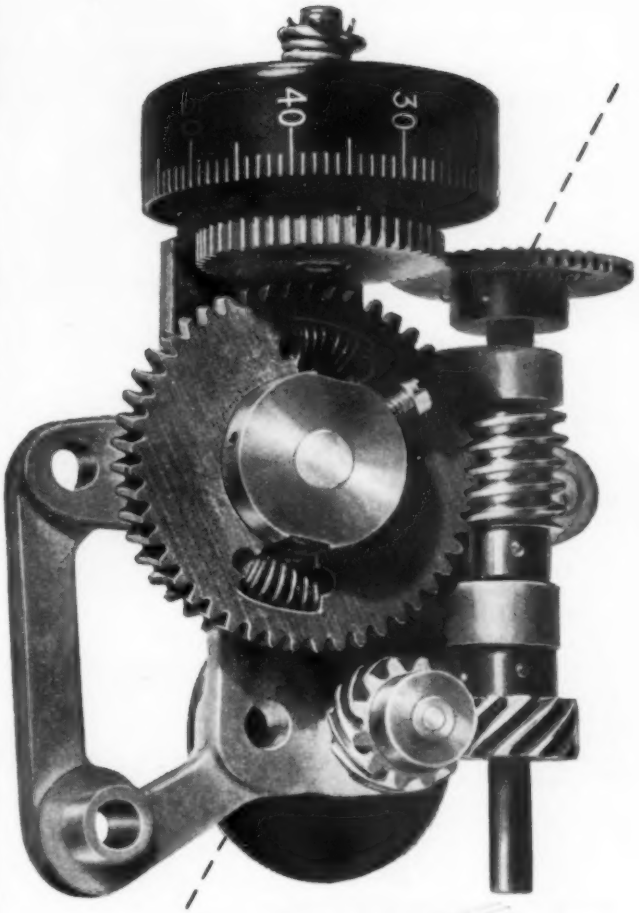
SPURS • HELICALS • BEVELS
(Straight & Spiral)
WORM GEARING • THREAD GRINDING
(14 to 96 D. P.)

This range logically embraces the gear components of many critical control devices essential to the war effort and this organization is proud of its contributions of such material in the program.

With full *production capacity* scheduled far into the future, all new inquiries are now necessarily subordinated to these vitally important prior commitments. However, every *urgent* need will be given careful consideration.

Gear Specialties
MANUFACTURERS
CHICAGO

2600 W. Medill Av. **Ph. Hum. 3482**



In base to plane communication one of the vital contributing factors toward the accuracy of pin point tuning is precision gears, and we are proud to say that QUAKER CITY GEARS are playing their part in assuring this accuracy.

Quaker City Gear Works
INCORPORATED

1910-32 NORTH FRONT STREET, PHILADELPHIA, PENNSYLVANIA

THE JOHNSON FRICTION CLUTCH

The NEW "MAXITORQ"

MULTIPLE DISC DESIGN IS SIMPLY ADJUSTED and EASILY CONTROLLED

Double

The use of separator springs between the active discs in the JOHNSON "MAXITORQ" FLOATING DISC CLUTCH assure quick disengaging and prevent excessive drag. Abrasion and heat common to many clutches of the multiple disc type are absent in the "MAXITORQ."

Single

This new development by Johnson is provided with a very simple manual adjustment so that smooth operation can be maintained under all power transmission requirements. Sensitive starting, safety and quietness are other advantageous operating features.

Made in capacities from ½ HP to 5 HP at 100 R.P.M. in single, double and cut-off coupling types. WRITE FOR DIMENSION SHEETS covering all sizes and types.

Write for Multi-Disc clutch catalogue No. 64 or consult Sweet's or Thomas' Reg.

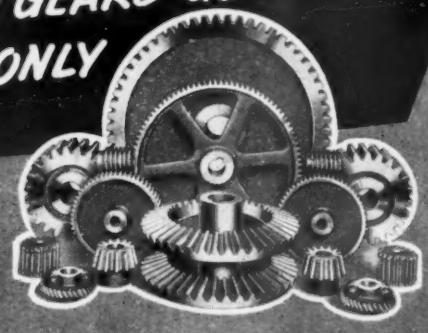
THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN

WHERE PERFORMANCE MUST BE RIGHT . . .

The outstanding performance of Cincinnati Gears may well be attributed to our experience, knowledge and skill in producing the right gears for the job.

Where performance must be right you'll usually find Cincinnati Gears giving longer gear life and greater production.

GEARS-GOOD GEARS ONLY



THE CINCINNATI GEAR COMPANY

"Gears . . . Good Gears Only"

Wooster Pike and Mariemont Ave. • Cincinnati, Ohio

GRANT GEARS

"64 YEARS" MANUFACTURING GEARS

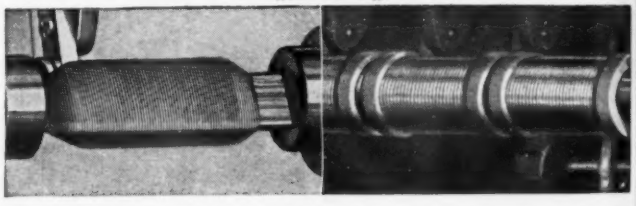
Despite the continued growth of our gear business we are still in position to give each customer the attention they have a right to expect.

We carry a complete stock of standard cut gears and can furnish special gears to your specifications.

GRANT GEAR WORKS

BOSTON, MASS.

ESTABLISHED 1877 — BY GEO. B. GRANT

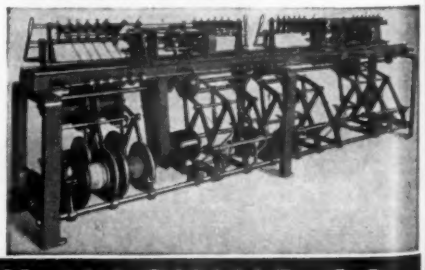


FIDELITY WIRE SPOOLING MACHINES

. . . from Reels or Coils
. . . to Sticks or Spools

Precision winding at high speed, with unvarying weight and even lay of wire on spool or stick are the outstanding advantages of FIDELITY Wire Spooling Machines. They are adjustable for required length, thickness or spacing. Simple operation requires minimum labor attention and low power.

Send for illustrated folder describing machines and operating specifications.



One of four standard FIDELITY Wire Spooling Machines—designed to turn out, rapidly and economically, neat, convenient packages. Special purpose machines designed to fit individual needs.

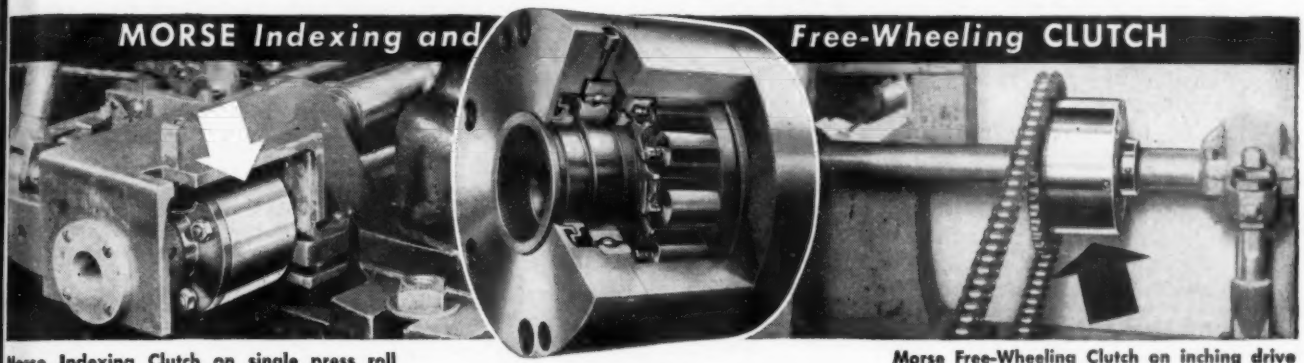
FIDELITY MACHINE CO.

3908-18 FRANKFORD AVE., PHILADELPHIA

MORSE CLUTCHES
Meet Many Needs

High quality functional clutches designed in a wide range of sizes and capacities for indexing, free-wheeling and backstop service.

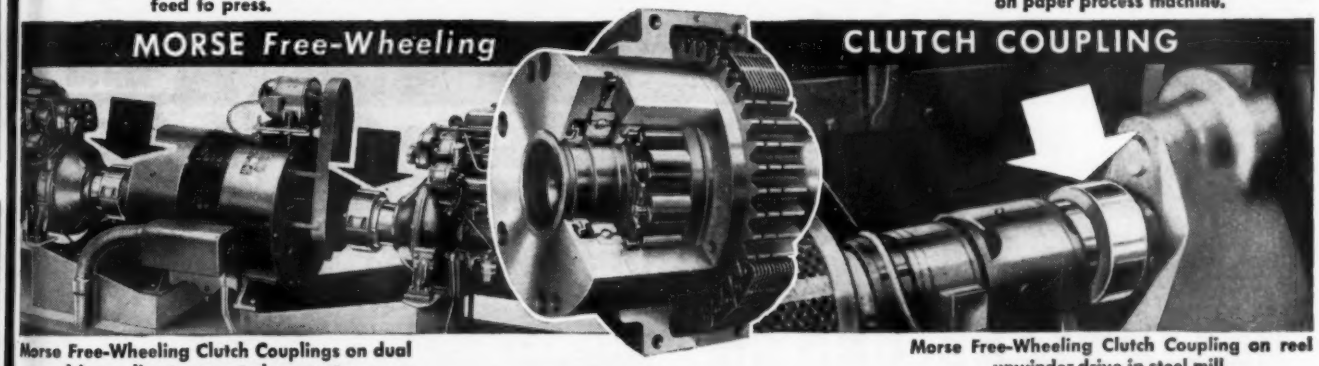
MORSE *Indexing and* *Free-Wheeling* CLUTCH



Morse Indexing Clutch on single press roll feed to press.

Morse Free-Wheeling Clutch on inching drive on paper process machine.

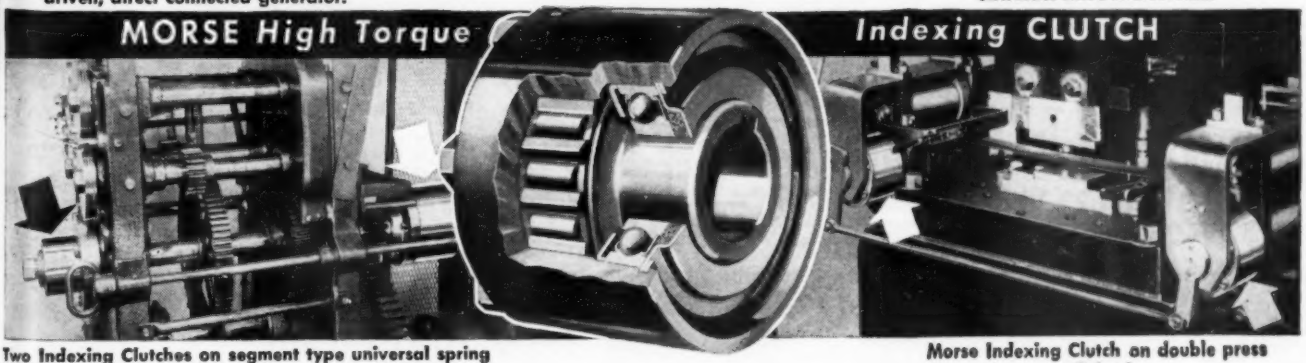
MORSE *Free-Wheeling* CLUTCH COUPLING



Morse Free-Wheeling Clutch Couplings on dual driven, direct connected generator.

Morse Free-Wheeling Clutch Coupling on reel unwinder drive in steel mill.

MORSE *High Torque* *Indexing* CLUTCH



Two Indexing Clutches on segment type universal spring coiler . . . one for feeding wire, the other for backstop.

Morse Indexing Clutch on double press roll feed.

Morse precision products also include silent and roller chain drives, sprockets, chain couplings, Morflex Couplings, Radial Couplings, Pullmore clutches, automotive time chains and marine drives.

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA, N. Y. DETROIT, MICH. DIVISION BORG-WARNER CORP.

Positive action of BARRETT TYPHOON CENTRIFUGAL WASHERS provides for quick, thorough parts cleansing

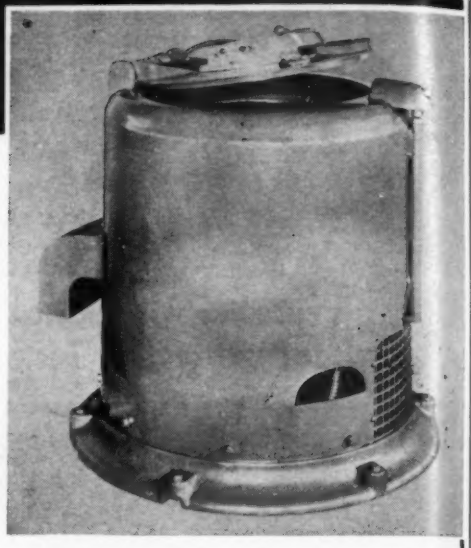
In these efficient centrifugal machines the washing solution enters the top of the whirling load under valve control. The operating principle—being that of a typhoon—gives the washing solution a spraying, swirling, and surging action which thoroughly permeates the contents. During this action, centrifugal force creates hydrostatic pressure within the basket. That proportion of the deluge going to the bottom is forced up the side and out carrying off the contaminated fluid.

A thorough, quick cleaning is definitely assured by flowing sequence. Two or more liquids may follow, making it possible to wash, rinse or provide any further treatment as required.

Several Barrett installations involve the use of four machines operated by one man who loads and unloads in three minute cycles. Washing time is only one minute. Another type of set-up provides for recovering oil, washing, drying, and coating with rust-proofing material.

As in all Barrett Centrifugal machines, provision is made for convenience and safety of operation.

Send at once for details of Barrett Typhoon Washer



Barrett Centrifugal Washer—made in capacities from 13 to 38 cu. ft. per hour. Each size, depending on condition, will perform at the rate of 20 duty cycles per hour.

THE LEON J. BARRETT CO., WORCESTER, MASS.

Designers and Builders of Centrifugal Machinery

ELLIPTICAL GEARS

Also Other Non-Circular Gears

ALL TYPES OF GEARS

BILGRAM GEAR & MACHINE WORKS

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BRAWNY GEARS

PROMPT
ECONOMICAL SERVICE
ALL TYPES, MATERIALS
AND QUANTITIES
Ask for Estimate

BRAUN GEAR CO., 1590-1608 Atlantic Ave., Brooklyn, N. Y.

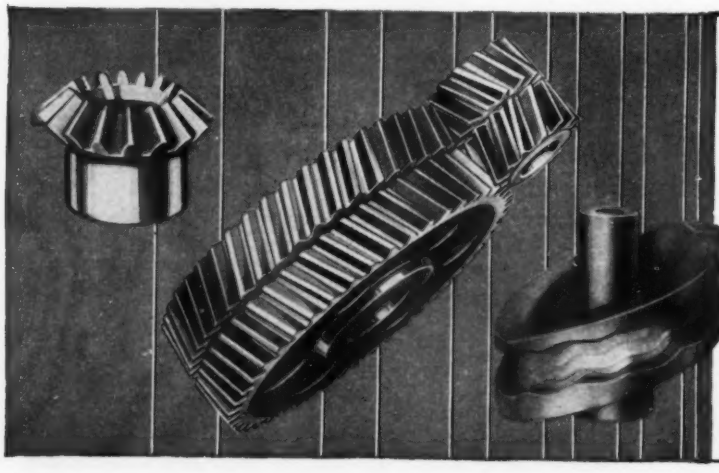
GANSCHOW GEARS

FOR SIXTY YEARS

Spur—SPEED REDUCERS—Worm

ALL TYPES OF CUT GEARS

GANSCHOW GEAR CO., 18 N. Morgan St., Chicago



GET YOUR QUOTATION *from* "HARTFORD"

GEARS of every description cut to order

GEAR, CAM and THREAD grinding

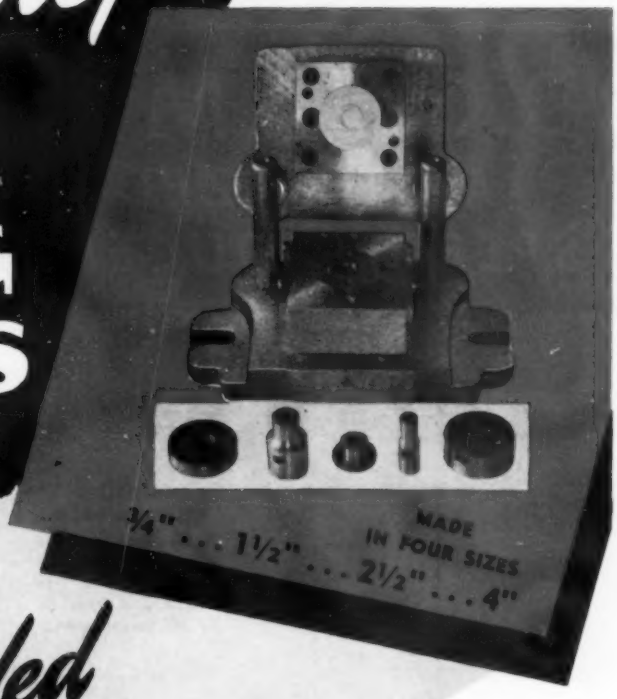
AERONAUTICAL PARTS on contract basis

Send blue prints or samples for estimate. Accuracy of work guaranteed to your specifications.

THE HARTFORD SPECIAL MACHINERY COMPANY

HARTFORD CONNECTICUT

This Great Forward Step in MAKING WASHERS



Has Come at a Time When Needed Most!

IT ASSURES A TREMENDOUS SAVING IN STEEL AND STORAGE SPACE

RIGHT now, when wartime production demands speed and the conservation of critical materials, HOVIS UNIVERSAL MASTER WASHER DIES are a positive necessity . . . And they will serve with equal importance after hostilities end.

With a set of Hovis Dies, you can make literally thousands of different sizes of washers. You merely assemble FIVE INTERCHANGEABLE PARTS into any one of four sizes of Master Dies, which make a complete die, ready to make a new size washer.

This simple method saves materials and the cost of making a new die for each size and type of Washer. MAIL COUPON TODAY.

HOVIS

SCREWLOCK CO

8098 E. Nine Mile Road

Van Dyke Michigan

Suburb of Detroit - Phone Centerline 1575

HOVIS SCREWLOCK COMPANY
8098 E. Nine-Mile Road, Van Dyke, Michigan

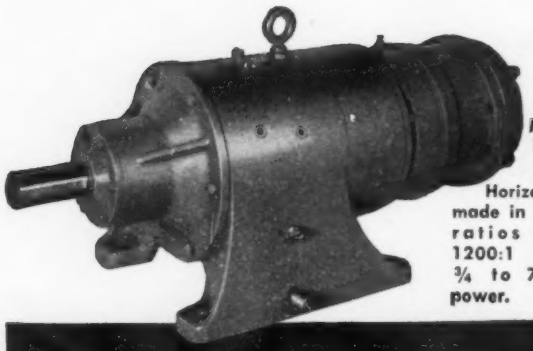
Please send me your new illustrated folder, showing "THE HOVIS WAY" of making washers.

My name is .....

Company .....

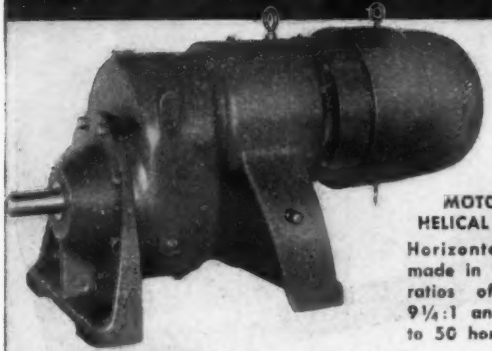
Street address .....

City ..... State .....



MOTORIZED PLANETARY REDUCER
Horizontal drive, made in 35 sizes in ratios of 10 to 1200:1 and from ¾ to 75 horsepower.

D.O.JAMES
MOTORIZED SPEED REDUCERS



MOTORIZED HELICAL REDUCER
Horizontal drive—made in 13 sizes in ratios of 1¼ to 9¼:1 and from ¾ to 50 horsepower.

ARMY E NAVY

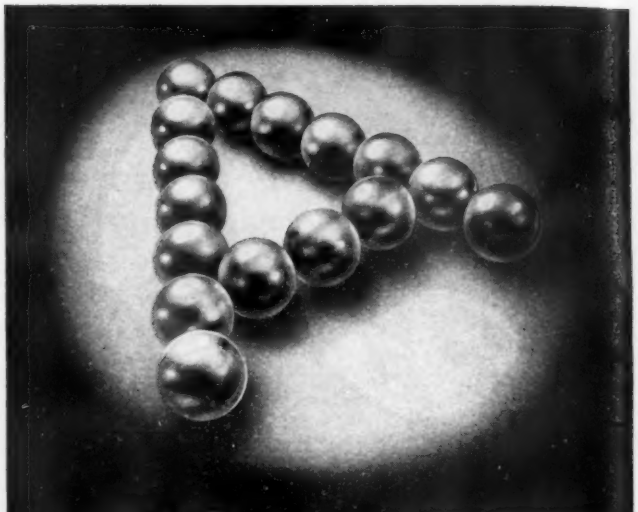
MOTORIZED WORM GEAR REDUCER
Horizontal drive—made in 11 sizes in ratios of 6 to 80:1 and from ⅛ to 50 horsepower.

SAVE ESSENTIAL AND VALUABLE SPACE

War time requirements make the D.O.James Motorized Reducers a very important *Must* in solving and meeting the power-saving needs of modern industry. Their accessibility and compactness make them most desirable when floor space is limited. Their soundness of design and manufacture insures maximum efficiency with minimum maintenance.

D.O.JAMES MANUFACTURING CO.
Established 1888
1140 W. Monroe Street Chicago, U. S. A.

MAKERS OF ALL TYPES OF GEARS AND GEAR REDUCERS

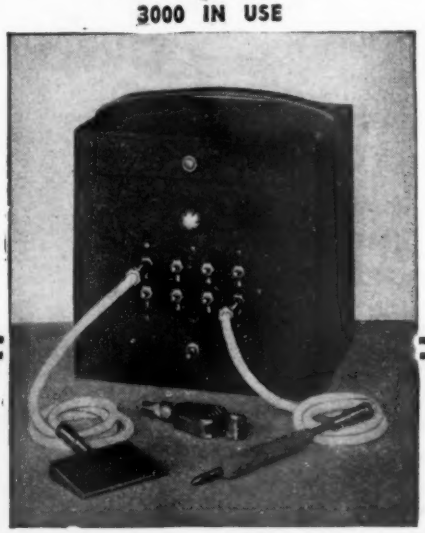


ROLL ON ABBOTT *Bearing* BALLS

KEEP 'EM A ROLLING

THE ABBOTT BALL COMPANY HARTFORD, CONN. U.S.A.

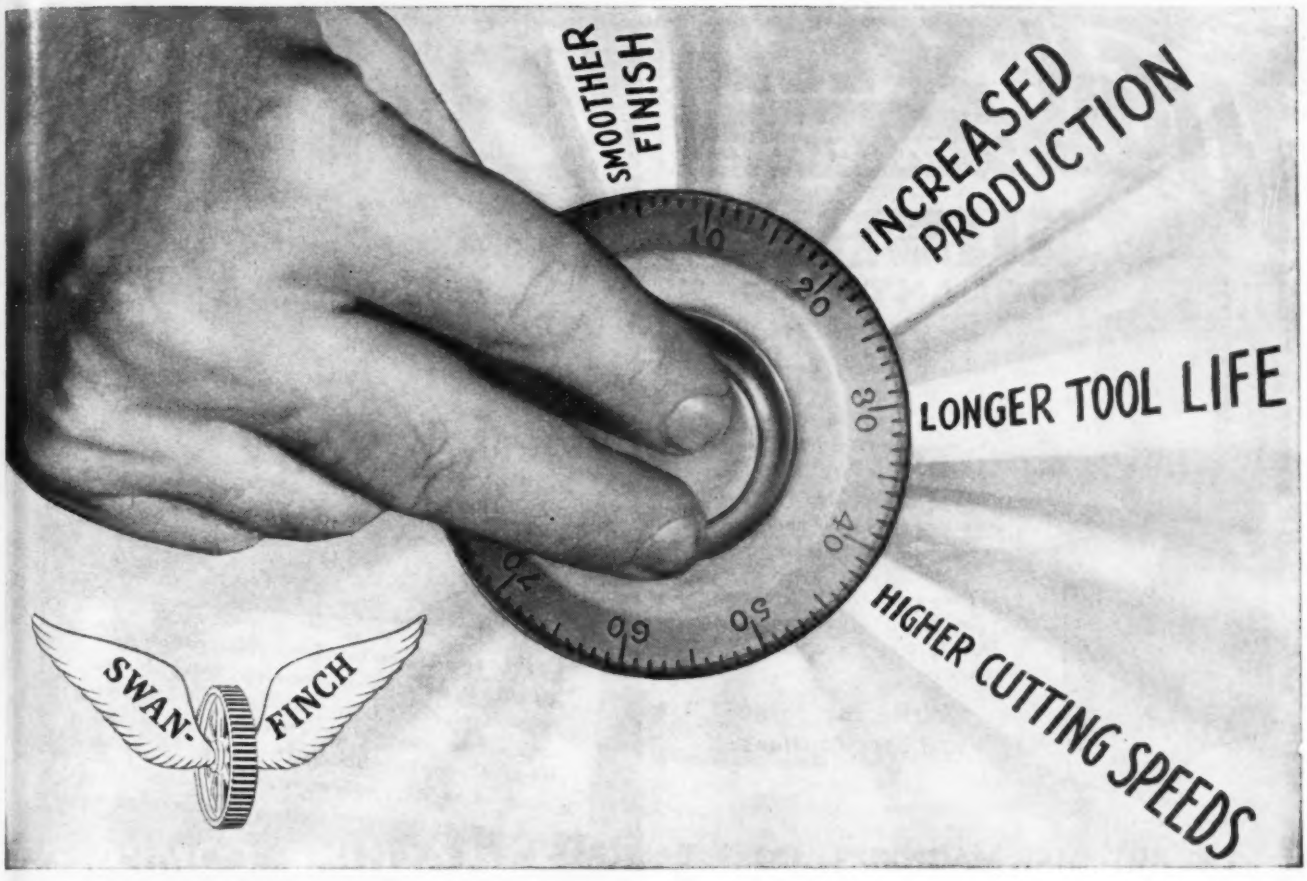
Why Not Buy the Original Electric Etcher?
MARK IRON *and* STEEL
THE Etchograph WAY
3000 IN USE



Mark parts in process, tools, dies, gages and fixtures of any ferrous metals including the hardest alloys and carbides—quickly—plainly.
Three sizes to meet all requirements.

Write for circular and prices

BREWSTER-SQUIRES & CO.
Hudson Terminal Bldg. New York, N. Y.



SAFCO METAL WORKING LUBRICANTS

Right Combinations for increased production!

Right combinations of ingredients in metal working lubricants are like the right numbers on the dial of a safe, each one vital for opening wide the doors of production.

Swan-Finch 'SAFCO' metal working lubricants are combinations that have been continuously proved as scientifically correct.

Today high production schedules and precision specifications do not permit guesswork.

Swan-Finch, the makers of 'SAFCO', are lubrication specialists in the metal working field.

That's why more important plants engaged in vital war production are testing and specifying 'SAFCO' lubricants.

It will pay you real dividends to get better acquainted with the Swan-Finch field representative who covers your district. Capable and able, they are constantly devising *new* ways and means for stepping up production.

For instance meet A. J. ("Al") Goffinet. He is one of our highly trained and experienced staff of fieldmen.

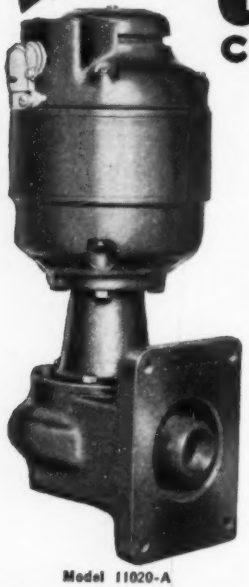
ASK US TO HAVE HIM CALL—NO OBLIGATION.

SWAN-FINCH OIL CORPORATION

Offices		Plants	
New York City—Executive Offices	R.C.A. Building, West	Newark, N. J.	120 Lister Avenue
Chicago, Ill.	201 North Wells Street	Chicago, Ill.	5849 West 66th Street (Clearing, Ill.)
Detroit, Mich.	2596 Hart Avenue	Detroit, Mich.	2596 Hart Avenue

For HIGH-SPEED Production

GUSHER COOLANT PUMPS



Model 11020-A

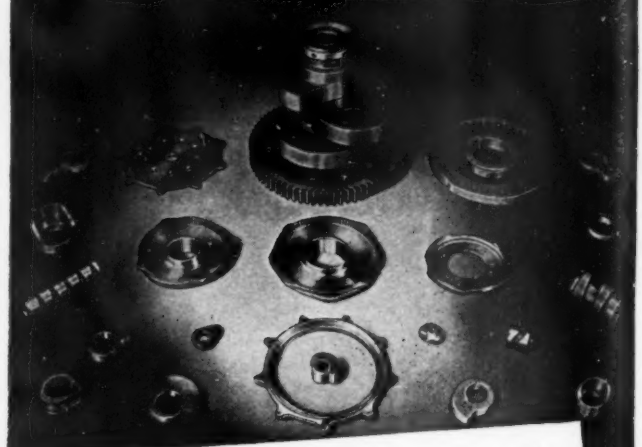
Full ball bearing design minimizes friction . . . no pump priming . . . not injured by small chips and grit . . . split-second control, these and other features of Gusher Coolant Pumps help you meet your high speed production schedules.

There's a "Gusher" to meet your needs. Types and sizes from 1/10 to 2 h.p.

Write for data and specifications

THE RUTHMAN MACHINERY CO.
1809 READING ROAD CINCINNATI, OHIO
LARGEST EXCLUSIVE BUILDERS OF COOLANT PUMPS

CAMS



LET the largest, most completely equipped cam milling plant in the mid-west handle your cam problems. All sizes of drum, face, groove or other styles of cams cut to order in quantities of one or one thousand. Send specifications or blueprints for a quotation on your requirements.

KUX MACHINE COMPANY
3930-44 W. HARRISON, ST. CHICAGO, ILL.

You get Speed - Accuracy - Close Tolerance - all in one plate because

Smith Master SURFACE PLATES ARE Masters

ELLIPTICAL RIB CONSTRUCTION EXCLUSIVE WITH SMITH

Smith Master Surface Plates have become the standard for precision accuracy in numerous aircraft and ordnance plants all over the country. Gauge makers who want a superior surface plate and precision accuracy should not delay getting a Smith Master Surface Plate. For prices and delivery wire, phone or write.

SMITH TOOL & ENGINEERING CO.
851 N. Sandusky Ave. Bucyrus, Ohio

AVAILABLE SIZES
8" x 12"
9" x 14"
12" x 18"
18" x 18"
18" x 24"
24" x 24"
20" x 30"
24" x 36"
30" x 36"
30" x 60"
36" x 68"
48" x 96"

Smith Surface stands make ideal working units.

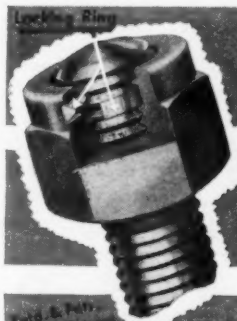
PRECISION MEASURING EQUIPMENT

HARDNESS TESTER

Let the SCLEROSCOPE speed up the production of that s so we can blow the Axis to HELL

Write for Circular!

THE SHORE INSTRUMENT & MANUFACTURING CO., INC.
9025 VAN WYCK AVENUE
JAMAICA, NEW YORK
TELEPHONE: JAMAICA 6-4090



UNSHAKO

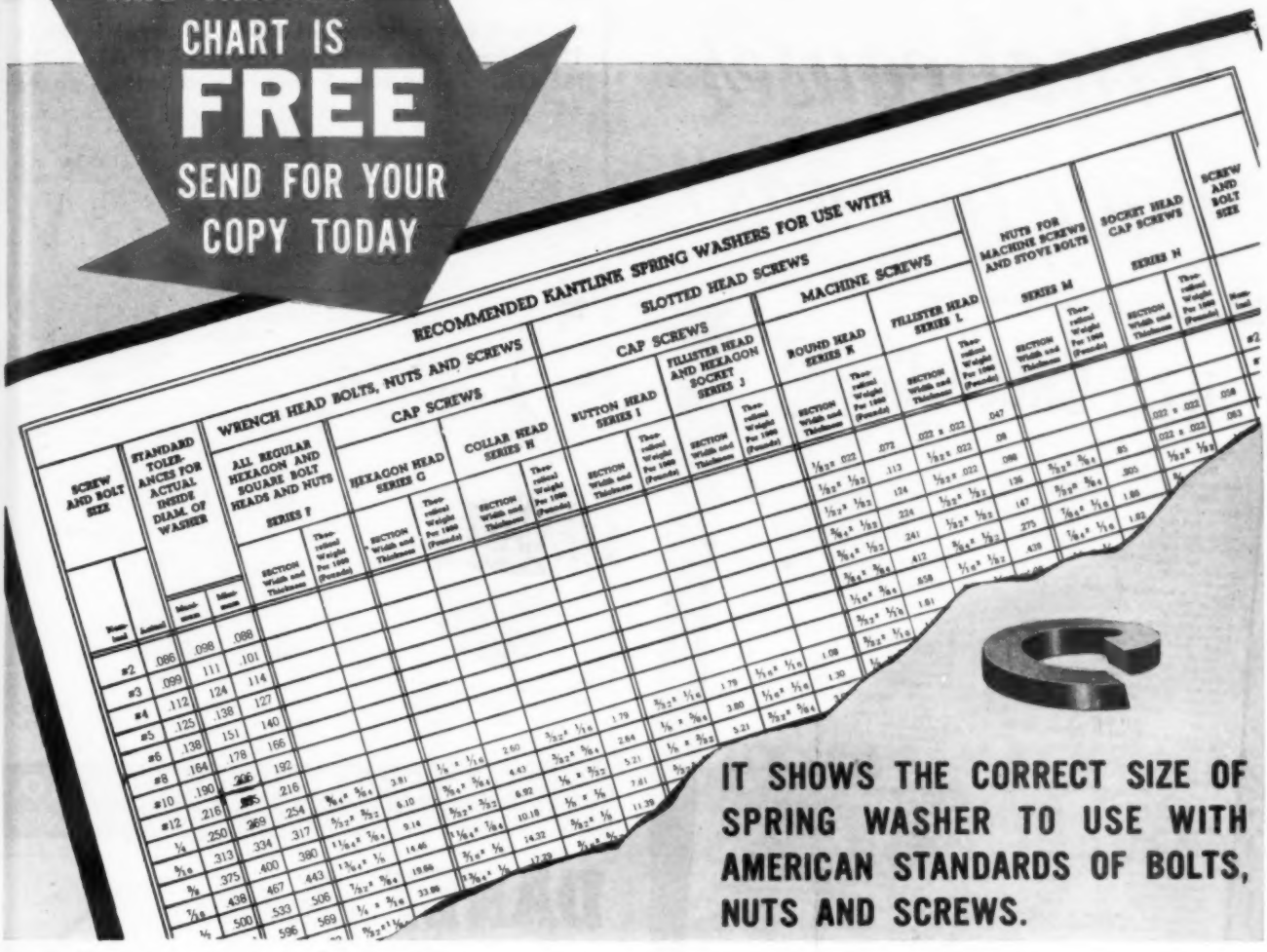
Reg. U. S. Pat. Off.

SELF-LOCKING NUT HOLDS TIGHT

Patd. & Pats. pending. Cut-away section showing locking ring in place.

STANDARD PRESSED STEEL CO.
BOX 4 JENKINTOWN, PENNA.

THIS VALUABLE CHART IS **FREE** SEND FOR YOUR COPY TODAY

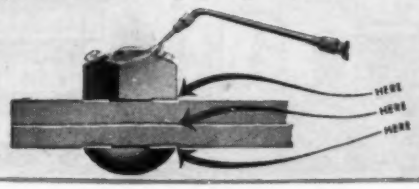


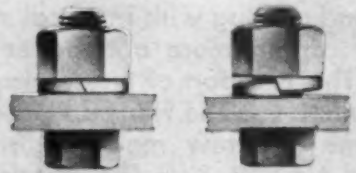
IT SHOWS THE CORRECT SIZE OF SPRING WASHER TO USE WITH AMERICAN STANDARDS OF BOLTS, NUTS AND SCREWS.

These tables deserve most careful consideration. They result from many years experience and research in cooperation with the testing staffs of industrial concerns and the mechanical engineering laboratory of one of America's largest universities. Please write on your letterhead for a free copy.

A strong spring washer is essential on practically every bolted assembly. But for greatest economy, efficiency and for safety —you should use the correct size as shown on this chart.

Even if you welded the nut and bolt into one immovable mass, vibration would wear the assembly loose—unless you used a strong spring washer.





Yes it's still tight because a strong spring washer held it tight by expanding as fast and as far as inevitable wear tended to loosen the parts.

There is no substitute as economical. No fixed nut nor any short-range multi-toothed washer can possibly equal the great holding power of a long-range live spring—a big helical spring such as Kantlink. Write today to

THE NATIONAL LOCK WASHER COMPANY, Newark, N. J., U. S. A.

What causes poor threads?

H&G CHECK CHART

A GUIDE TO BETTER SCREW THREADS

Under war conditions, it becomes more and more important that we get the most we can out of the tools and materials that we work with.

Reducing the amount of scrap is the same as increasing the quantity of tools and materials available for war work.

If you are cutting screw threads, you will find the "Check" list shown below, a valuable guide towards better efficiency. If you are having any difficulties, find them in the following list and check the causes mentioned.

SO CALLED TAPER THREADS

Poor alignment.
Poor start.
Drag due to machine conditions.
Bad camming.
Chasers shave*
Loose front plates or
Dirt under front plates.
Dirt in chaser slot of carriers, throwing chasers out of trackage or off on length, causing shaving condition.
Worn locking mechanism.
Bent Die Head shanks.
Die Head needs overhauling.
Chasers or carriers sloppy fit in Die Head.

OFF LEAD

Chasers cut hard, due to improper chamfer relief.
Chasers are forced.
Chasers are held back by drag.
Chasers shave.*

ROUGH THREADS

Material cuts poorly.
Dull chasers.
Poor grinding
Improper cutting fluid.
Too high speed.

POOR THREADS AT START

Poor grinding.
Hesitating start or
Poor camming
Poor alignment.

Look thru past issues of "Die Headlines" where these subjects are dealt with. Write for any copies you may have missed and for any of the instruction books shown on the last page.

THREADS DO NOT FIT GAGES

Threads off lead.
Threads taper.
Poor thread form.
Improper setting of the gage itself or worn gage.

POOR MACHINE CONDITIONS

Non-alignment.
Poor condition of spindle.
Cramping action.
Improper camming.
Too much float.
Improper speed.
Improper flow of cutting lubricant.

CHASER BREAKAGE

Chasers hit shoulder.
Worn chasers.
Dull chasers.
Improper grinding.
Back drag in machine.
Chip Shavings in Die Heads.
Chasers or carriers sloppy fit in Die Head.
Poor alignment.
Poor start.
Poor condition of threading spindle.
Improper cutting fluid.
Soft stock builds up false cutting edge.
Too small a die head for job.
Chasers not properly adjusted to size when starting.
Oversize stock, causing chasers to mill too much from O.D. or to start hard.

*To determine this, stop machine while cutting before die head opens and determine which chaser is shaving. Remove keenness of honed edges on teeth back of chamfer using a knife edge or very fine hone.

Free—

To users of H & G DIE HEADS

THE Check Chart illustrated above will be mailed upon request together with the current copy of "DIE HEADLINES" an informative publication issued from time to time and dealing with practical suggestions for cutting more and better screw threads. This is a part of the service given to users of H & G Die Heads. Please state the makes of screw machines and the style and sizes H & G Die Heads used.

H&G DIE HEADS

The Eastern Machine Screw Corporation
20-40 Barclay Street, New Haven, Conn.

DON'T WAIT FOR TURRET LATHES

Convert any engine lathe into a turret lathe in 15 seconds with JEFFERSON TURRET ATTACHMENTS. To fit bench lathes and lathes up to 24" swing.

● This new modern TOOL-POST TURRET (below, right), made in 2 sizes, designed to increase production on engine lathes. Easily mounted on cross slide or compound rest. Has capacity of 4 standard tool holders which are easily inserted and rigidly held.

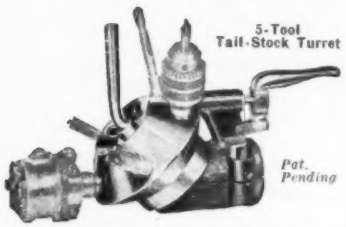
6 Days Delivery

Pat. Pending

4-Tool Tool-Post Turret

● Then there's the completely modernized 5-tool TAIL-STOCK TURRET (below right), made in 4 sizes to fit small bench lathes and lathes up to 24" swing. Also the adjustable PULL-FEED LEVER. Jefferson Turrets are real production tools—substantial, rigid, accurate. They must not be confused with the small make-shift gadgets now on the market.

The Jefferson Bull-Dog Precision Milling Machine. Obtainable Power or Hand Feed.



5-Tool Tail-Stock Turret

Pat. Pending

● **ALSO—*Milling Machine Dividing Heads, Vises, Belt Sanders, Swing Frame Grinders, Gyratory Foundry Riddles.***

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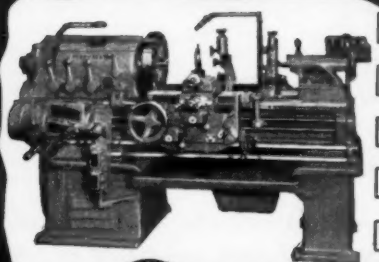

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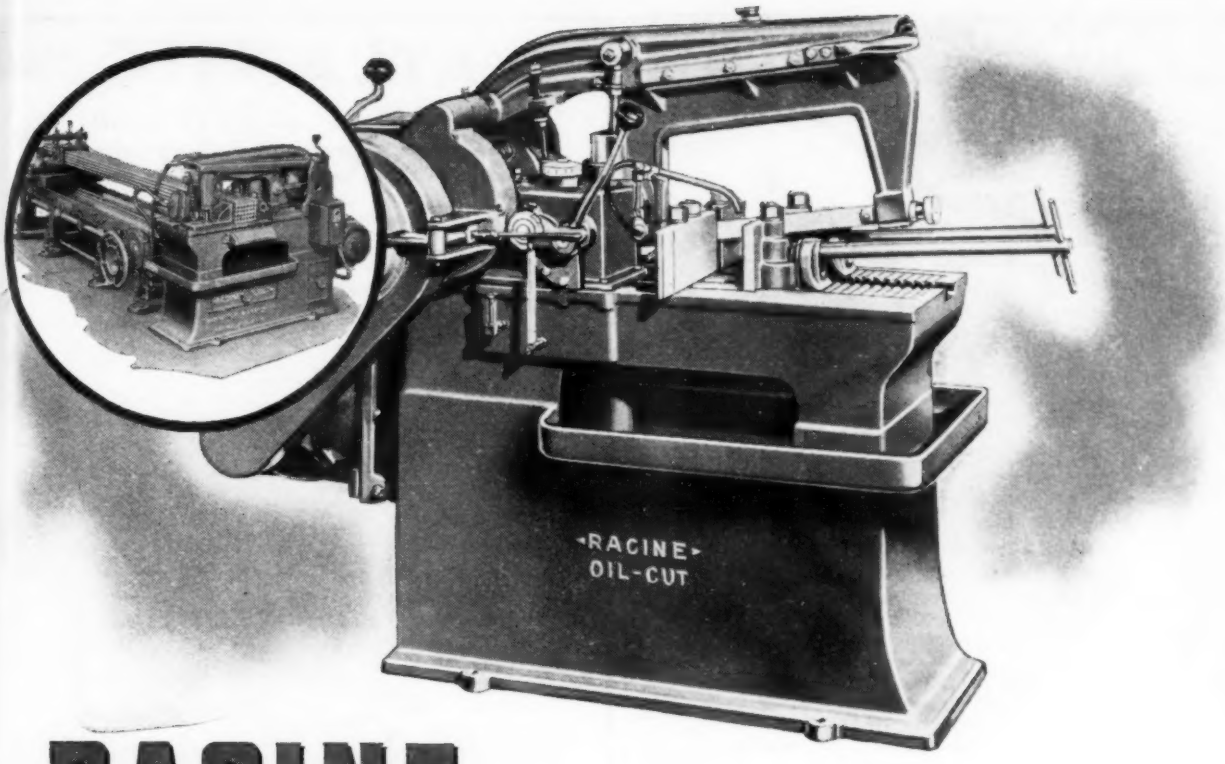

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THE PRODUCTION SAWS OF MODERN INDUSTRY

Operation No. 1 in Your Metal Cutting Department

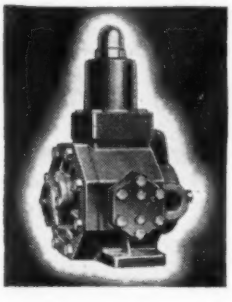
Start your production line with Racine accuracy—in the cutting of bars, tubing, and structural shapes.

This dependable accuracy is the result of Racine's rigid construction features and the Racine type of self-compensating, flexible hydraulic feed.

Racine was first to successfully apply the smooth oil-cushioned operation of hydraulic action to a power hack saw machine. Simple automatic hydraulic control of feed and pressure make Racine preferred by the inexperienced operators as well as the experienced operators in today's high speed war production. A single lever controls feed, clutch, transverse and neutral operating action—all from one operating position.

And Racine's extra heavy pivot shaft and wide pivot bearing in saw guide arm, prevents cocking or binding strain—greatly lengthening the life of the machine.

Investigate Racine's wide range of sizes—capacities 6″ x 6″ to 20″ x 20″. Racine Automatic Hydraulic Stock Feed Machines—that bring new labor-saving features to any metal cutting operation—are also available.



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HYDRAULIC PUMPS
A Modern Source of Hydraulic Force

A new "high" in vibrationless action is made possible by Racine Oil Hydraulic Pumps for any operation of feeding, bending, forming, holding or molding. Only Racine has the "Vane Type" Variable Volume feature—no relief valves are required. It pumps only the required amount of oil needed to do the job. Pressures from 50 to 1000 lbs. per sq. in. at 0 to 30 gal. per min.

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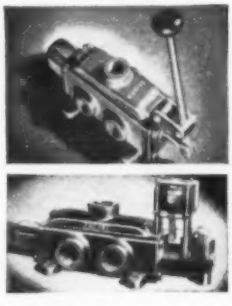
The exclusive Racine "Sleeve Type" and "Balanced Piston" construction provides larger bearing and sealing area. Piston cannot sag. Shock is reduced to a minimum in hydraulic circuit, because of Racine's unique "porting" design. These four-way valves are available with stem, lever, roller, latch, foot treadle and solenoid operating devices. Made in ⅜″ to 1½″ standard pipe sizes. "Custom-made" porting arrangements can be supplied to suit your specific requirements.



Racine's Hydraulic specialists will be glad to help you with your hydraulic application problem—with no obligation. Immediate attention will be given your request for complete information and prices on Racine Saws or Hydraulic Pumps and Valves. Address Dept. AM-S

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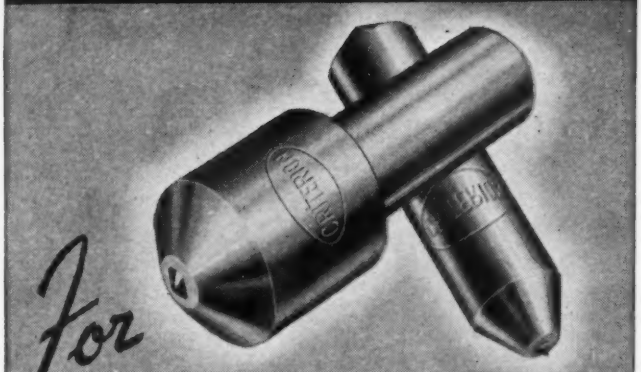

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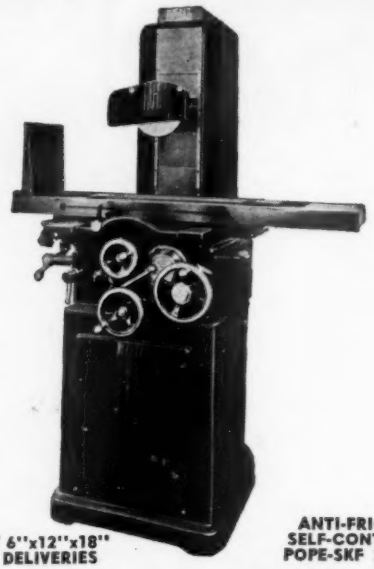

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This new catalog covers the production capabilities of the No. 1 and No. 2 Blake Tap Grinders from A to Z. It shows construction and operation features that are giving manufacturers thousands of extra holes from every tap. It shows standard and special equipment that is doing the unusual as well as the everyday tap sharpening jobs. It discusses correct sharpening methods for small lots or quantities of taps and other tools—any with relief at the point. It will pay you to mail the coupon today!

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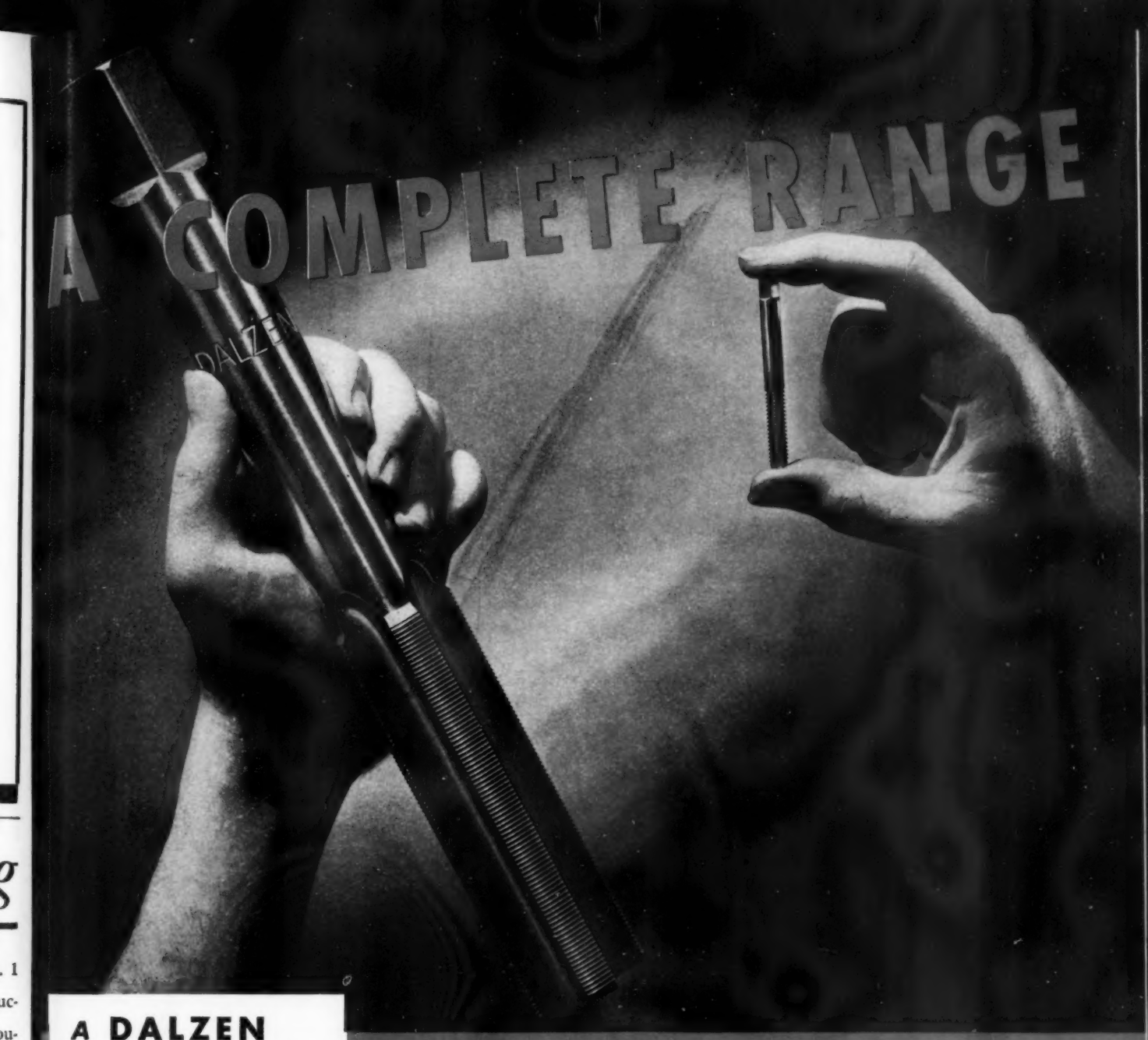

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DALZEN SPECIALIZES in hard-to-get Whitworth form taps from size 12-BA up to 6" in diameter.

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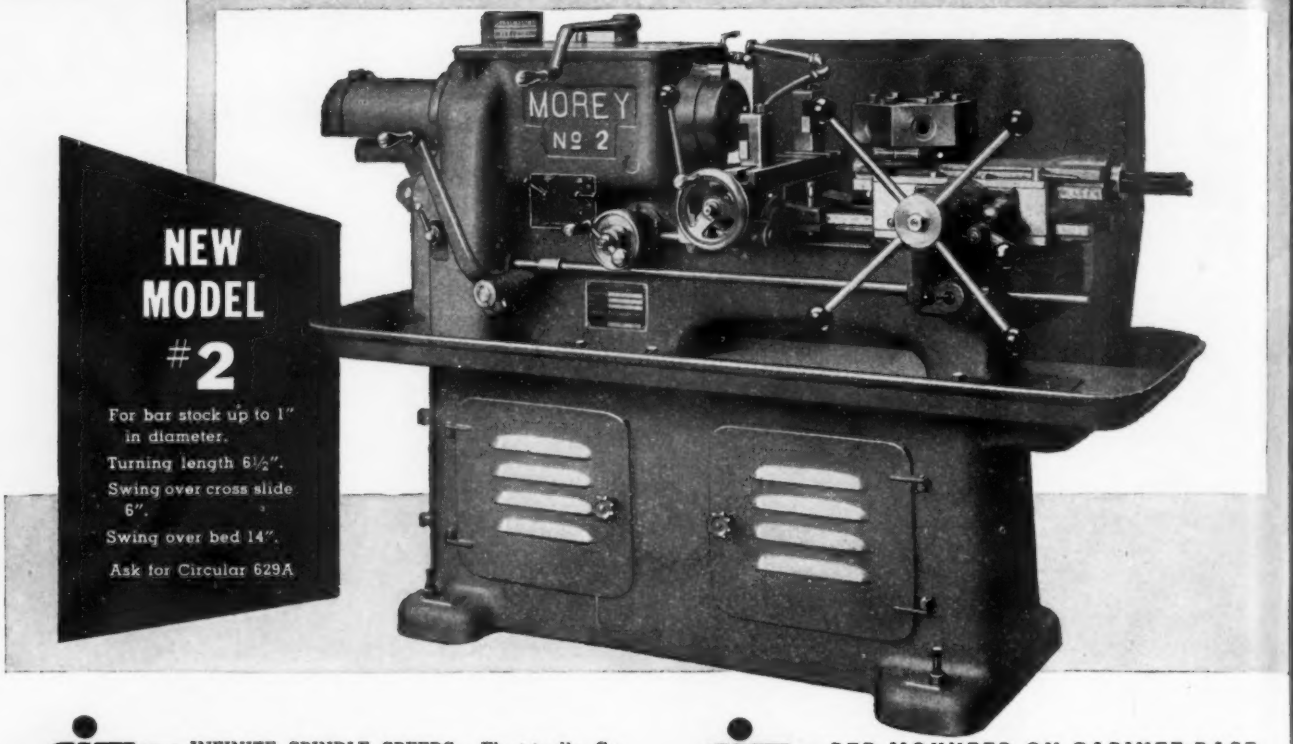
MOREY TURRET LATHES



NEW MODEL #2

For bar stock up to 1" in diameter.
Turning length 6½".
Swing over cross slide 6".
Swing over bed 14".
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  Constant horsepower at all speeds.
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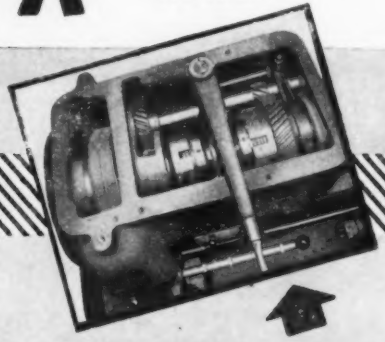
- SPINDLE SPEEDS AND POWER FEED CHANGES WITHIN EASY REACH OF OPERATOR.
- BED MOUNTED ON CABINET BASE.
- MOTORS AND STARTING EQUIPMENT EASILY ACCESSIBLE.
- HEXAGON TURRET AUTOMATICALLY UNCLAMPED, INDEXED AND CLAMPED.
- THREE TYPES OF CROSS SLIDES AVAILABLE:
  Lever Feed
  Screw Feed
  Combination Feed*

  *Combination feed provides instantaneous selection to either lever or screw feed.
- EIGHT (8) FEED CHANGES FOR THE UNIVERSAL CARRIAGE and HEXAGON TURRET, INSTANTLY ENGAGED OR DISENGAGED BY ONE MOVEMENT OF THE LEVER.



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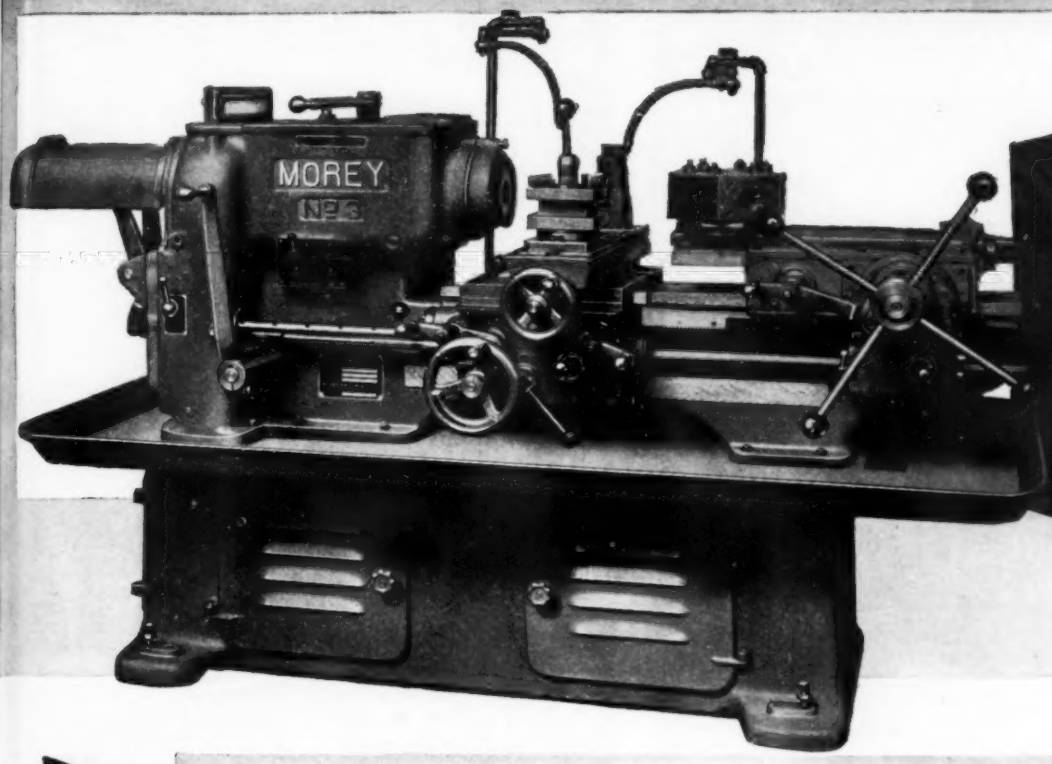


#3 UNIVERSAL

For bar stock up to 1½" in diameter.

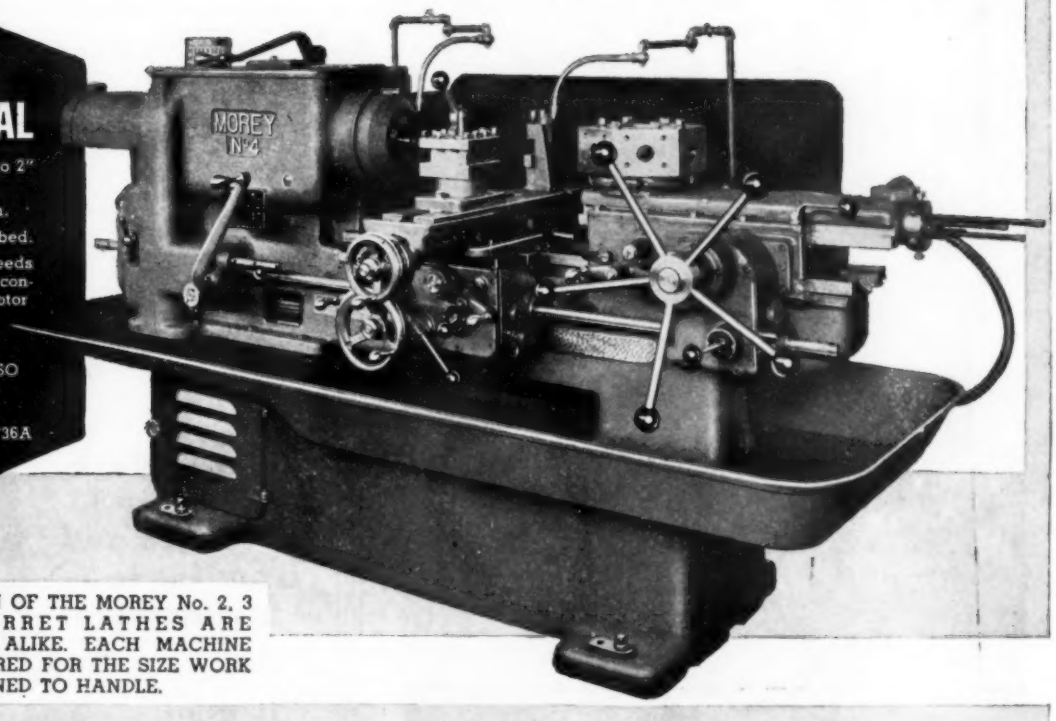
10" turning length.

16½" swing over bed.

Infinite spindle speeds 55 to 1800 RPM, constant speed motor, 1200 RPM.

AVAILABLE ALSO WITH PLAIN CROSS SLIDE

Ask for Circular 727A



#4 UNIVERSAL

For bar stock up to 2" in diameter.

12" turning length.

19½" swing over bed.

Infinite spindle speeds 35 to 1500 RPM, constant speed motor 1200 RPM.

AVAILABLE ALSO WITH PLAIN CROSS SLIDE

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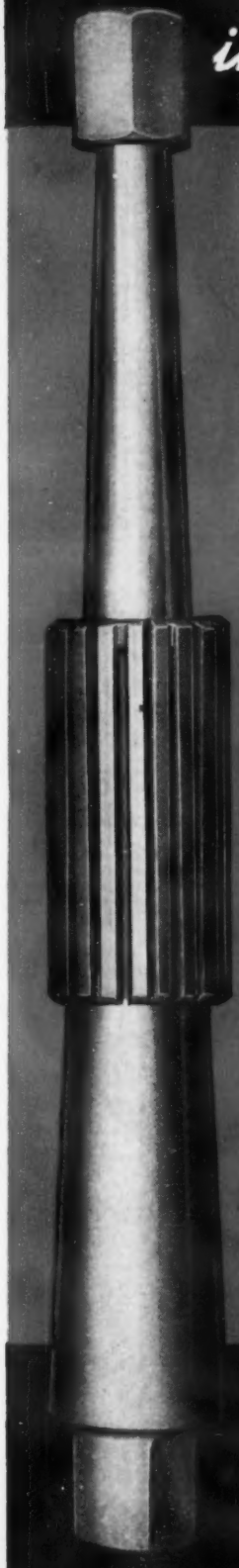

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will pay for themselves by the time each has been used on its second job for which special solid arbors would otherwise have been made.

K-O Expanding Mandrels are made of high quality steel, hardened and ground, and accuracy of less than .001" is maintained for the life of the mandrel. Size ranges will accommodate work from 3/8" to 5½". K-O Mandrels can be purchased singly or in convenient sets with metal boxes.

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TO THE MANUFACTURER

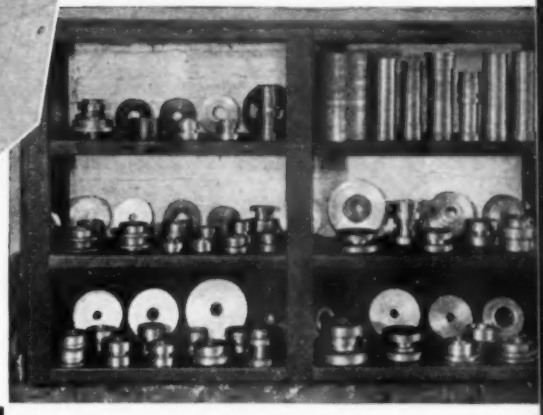
not get turning short runs

ON HIGH PRODUCTION AUTOMATIC LATHES

THESE CAST-IRON, STEEL AND BRONZE PARTS ARE TURNED **IN LOTS OF 25 TO 100** ON SUNDSTRAND AUTOMATIC LATHES WITH SAVINGS IN TIME UP TO **95%**

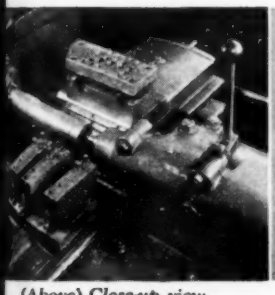
(Above) Two Sundstrand Model 10 Automatic Lathes for rough and finish turning parts on short-run work.

(Left) Rough sleeve blank, rough turned part, and finish turned part.

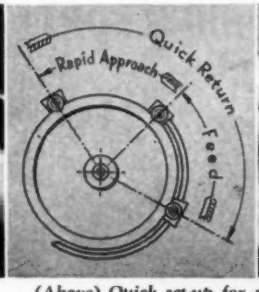


Quicker Set-ups for Short Runs

How the Sundstrand Quick Cycle Change speeds up production on short-run work.



(Above) Close-up view of tooling set-up for rough turning sleeve.



(Above) Quick set-up for short runs is accomplished by adjusting dogs on a graduated disk. Cycles are rapid approach, feed and quick return of 250" per minute. No cycle control cams are required.

Quicker set-up and easy change-over are possible with this simple cycle control. It eliminates making cams for every job to be turned. It provides complete control of all cycles by simple adjustment of dogs on a disk. Disk is graduated for ease and speed in setting up cycles, and changing from one job to another.

A total of six dogs controls all cycles. These provide control for conventional as well as intricate cycles. Rapid return is 250" per minute, and occurs immediately after cutting cycle is completed...no wait for cams to complete rotation.

Wide Range of Tool Action

A wide range of action for front carriage tools is provided by three units which can be used separately or in combination to give (1) angular feed-in and tool relief . . . (2) slow-up and dwell . . . (3) straight feed-in and tool relief. Many combinations are possible by merely making simple adjustments.

Easy to Operate

Unskilled help can consistently produce work to close limits with a Sundstrand Lathe. The operator merely changes work pieces and starts the automatic cycle. Usually one operator can handle two or more machines.

If you are not now getting the advantages of production turning on short-run work, investigate the possibilities of Sundstrand Automatic Lathes.

Turning Time Reduced from 75 Minutes to 4 Minutes... *On Lots of 40*

This progressive machine manufacturer increased production on more than 100 different short-run turning jobs. The parts include simple gear blanks, cluster gears, sprockets, pulleys, sleeves, etc., in lots of 25 to 100.

Set-up Time 45 Minutes

This sleeve was formerly machined in one hour and fifteen minutes. Two Sundstrand Automatic Lathes now rough and finish turn it in 4 minutes. The part is rough turned on one lathe, finished on the other. The Sundstrand quick cycle change makes possible setting up each machine in approximately 45 minutes. The parts are run in lots of 40, with one man operating both machines.

Let Sundstrand Engineers Help You With Your Turning Problems . . .

Let our engineers assist you in the selection of the proper automatic lathe for your job, and make tooling suggestions for faster turning of *both* short and long-run work. With wide experience on tooling for turning and milling, this competent staff of engineers is available, without obligation, to study your machining problems, and to suggest changes which will increase production, lower costs. Use this service freely. Send complete, accurate information with each inquiry.

How to Turn Short-run Work Faster . . .

is illustrated in this 16-page booklet describing the features of the Sundstrand Automatic Lathes. The quick set-up and easy change-over features are described in detail. Twenty-two front and six rear carriage cycle diagrams are also illustrated and described. Write for your copy today. Ask for Bulletin No. 113.

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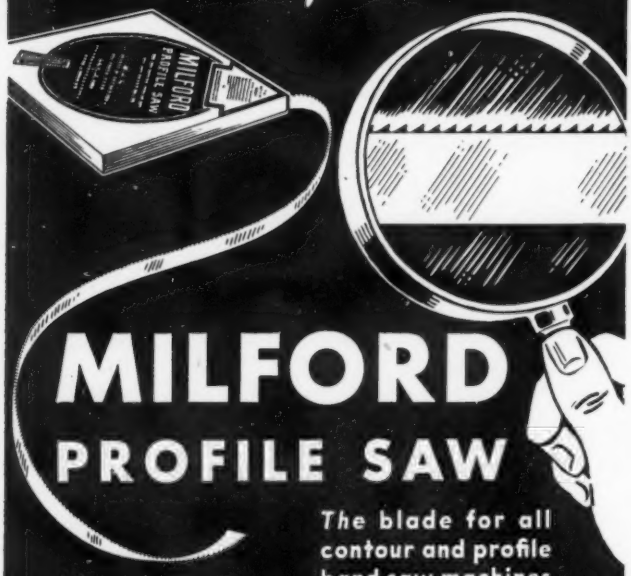
An improved



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Perhaps you have not yet adapted your band saw machines to Profile Sawing. In that case be sure to write us for directions giving description of cutting jobs and machines.

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Also, Lead Hammers, sizes 1 to 15 lbs. always in stock.

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Patented Cutting Off Blades

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Made by one of the older firms in the business, Sommerfeld Lathes combine the latest engineering developments with time-tested construction to provide dependable, economical production.

If you are interested in boring and turning, several lathes of the Sommerfeld line provide a unique method of *simultaneously* boring and turning, each operation being performed independently and at an economical feed. With this type of lathe, you save floorspace, manpower, time, and speed production.

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. . . offering modern features for quick, easy control . . .

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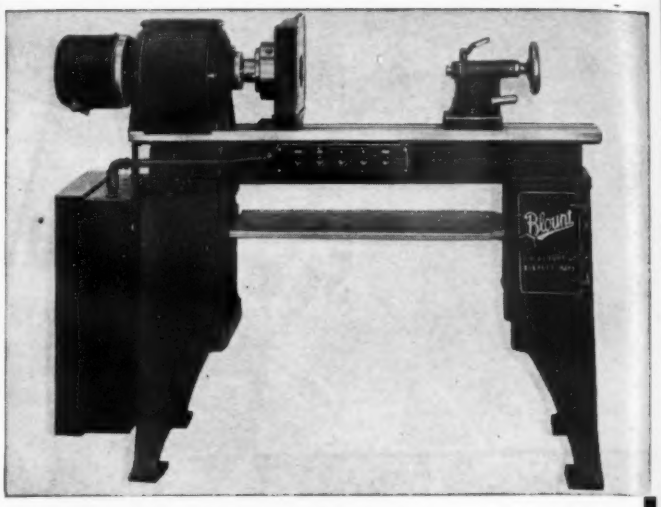
A Ball-Bearing Motor Type Headstock is used and is equipped with the very latest type selective speed pushbutton control, including magnetic contact panel. An automatic electric solenoid brake is provided for quick stopping and includes also a manual spindle release.

Lathes of similar type are generally furnished with four-speed drum controller, mounted on inside of leg (outside optional) also with reversing switch, and may include solenoid brake as Lathe B-2 together with chuck guard.

Standard equipment of Lathe Model B-2 includes "chuck guard" as well as six adapter plates or slides having various hold diameters to suit conditions.



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Equip your shop with these economy tools for holding work while being machined. Hardened tool steel—precision ground.

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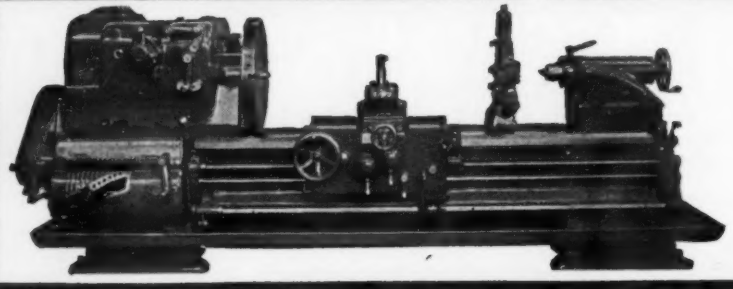
SPRINGFIELD GEARED HEAD LATHES



for peacetime or war production!

A lathe purchased now, for round-the-clock war production, must still meet peacetime requirements. Therefore, specify SPRINGFIELD lathes—flexible, efficient, ideal for emergency or normal production. SPRINGFIELD lathes are built in sizes from 14" to 30". Write for descriptive bulletins, prices, deliveries, etc.

The SPRINGFIELD MACHINE TOOL COMPANY • • • SPRINGFIELD, OHIO, U.S.A.

MACKLIN GRINDING WHEELS

HELPFUL HINTS

and

Safety Suggestions

YOU MEAN YOU SHOULD ALWAYS TRUE THE WHEEL FROM THE CENTER?
HEY! DONT TRY TO REMOVE ALL THE STOCK IN ONE PASS
Operators are often tempted to remove too much stock in one pass on the work. This causes the grinding wheel to break down too quickly, resulting in uneven wear and unsatisfactory finish.
[21]

FREE

INSTRUCTIVE BOOK STILL AVAILABLE

Now in its third printing this Know How illustrated 64 page booklet has proved an invaluable aid to grinding departments. Both large and small users of grinding wheels welcome the informative contents of this comprehensive book.

New grinder hands find "Helpful Hints and Safety Suggestions" particularly useful.

Your entire grinding department will find its many concise facts constructively valuable.

Ask for sufficient copies to be placed in the hands of all interested in grinding.

★

INVEST IN WAR BONDS

MACKLIN COMPANY

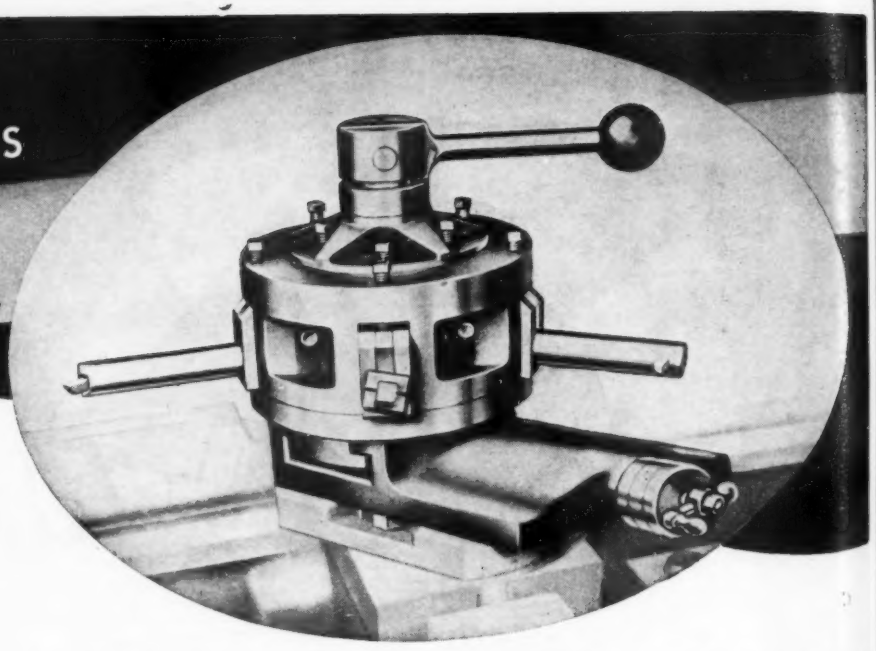
Manufacturers of GRINDING WHEELS — JACKSON, MICHIGAN, U. S. A.

Distributors in all principal cities

Sales Offices: — Chicago - New York - Detroit - Pittsburgh - Cleveland - Cincinnati - Milwaukee - Philadelphia

Improved
5-STATION TURRET HEADS

Make efficient, time-saving production tools out of conventional engine lathes



Five different operations with cutting tools in any of ten indexed positions can be handled on engine lathes equipped with these easily attached turret heads. Furthermore, set-up time is greatly reduced because all operations can be handled in a single chucking of the work. Even an inexperienced operator can obtain a big step-up in production over that possible on an ordinary lathe.

Cutting tools are rotated to the various stations by simply moving handle 1/8th turn, lifting it 45° and turning the head right or left to the indexed position required for the next operation. Lowering of handle to original position holds the head securely at the station. No special adapters are needed for tool bits, a feature which assures rigidity of tooling for heavy cuts. When desired, boring bars can also be used in these improved Turret Heads.

Write today for Descriptive Bulletin giving details of design and sizes available.

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PERFECTION IN MEASUREMENT
MEANS
PERFECTION IN YOUR PRODUCT

ATOMETRIC PRECISION GAGE LABORATORIES, Inc.
STAMFORD, CONNECTICUT, U. S. A.

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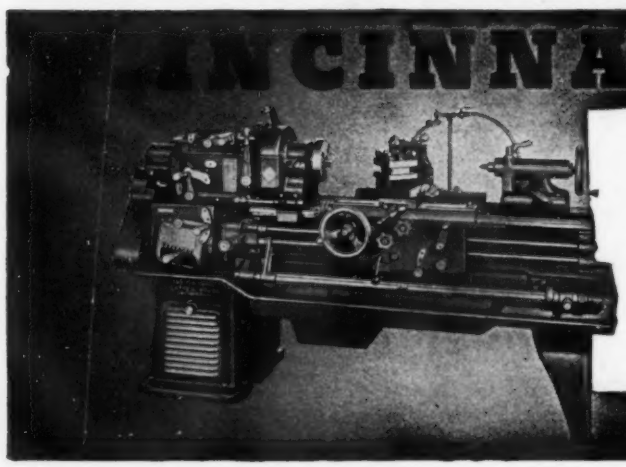

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Precision—on High Speed, Heavy Duty Machining

Load up Cincinnati Lathes to their full capacity—take heaviest cuts at highest speeds . . . their rugged construction guarantees constant precision! Built in 14" to 30" sizes, with 12 or 24 speeds and 32 to 96 feeds, they are designed throughout to handle the toughest jobs. Write for latest complete catalog.

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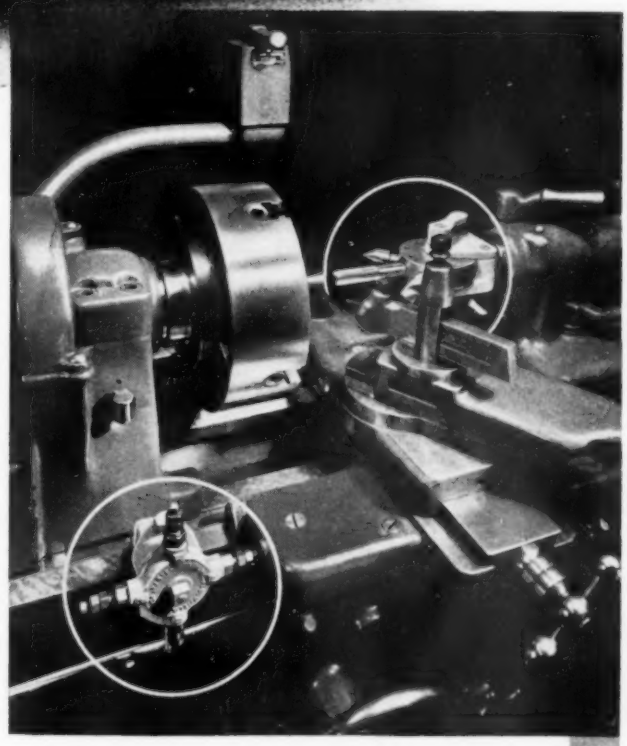
Rogers Road, Oakley SPECIALISTS SINCE 1906 Cincinnati, Ohio

Make Your Present Lathe Do 4 Operations With Only 1 Set-up



CUT COSTS—SPEED PRODUCTION WITH THIS TIME-SAVING TEAM

SPECIALTIES LATHE DEVICES more than double the productive capacity of your machine. Tapping, roughing, boring, finishing, drilling, reaming, forming and counter boring can be done without stops to change tools. You get easy, accurate control for important, precision lathe work.

SPECIALTIES TAIL STOP TURRET quickly converts your engine lathe into a 4-way turret lathe, sharply cutting your machine costs. It gives you four different working positions, each controlled by an indexing lever and held firmly in position by a clamp lever.

SPECIALTIES LATHE STOP is a practical time-saver since it requires measuring only once for each operation. The spring pin index automatically locks the spacer arm, insuring accuracy and efficiency.

USE THE COUPON TO GET DETAILED INFORMATION ON THESE SPECIALTIES DEVICES

Please send me full information on SPECIALTIES lathe accessories.

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Company_____

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THE ABRASIVE INTERNAL GRINDER No. IG

Available for Immediate Delivery

Originally designed for high production work grinding cartridge dies and similar small parts, the Abrasive Internal Grinder No. IG offers unusual flexibility and handles a wide variety of production and toolroom grinding jobs. Heavier in weight than most bench-type grinders, the No. IG is exceptionally rugged and accurate. Work spindle, of machine tool construction, mounted on super-precision ball bearings, is carefully sealed against abrasive grit. Diamond wheel dresser assures accuracy of hole size.

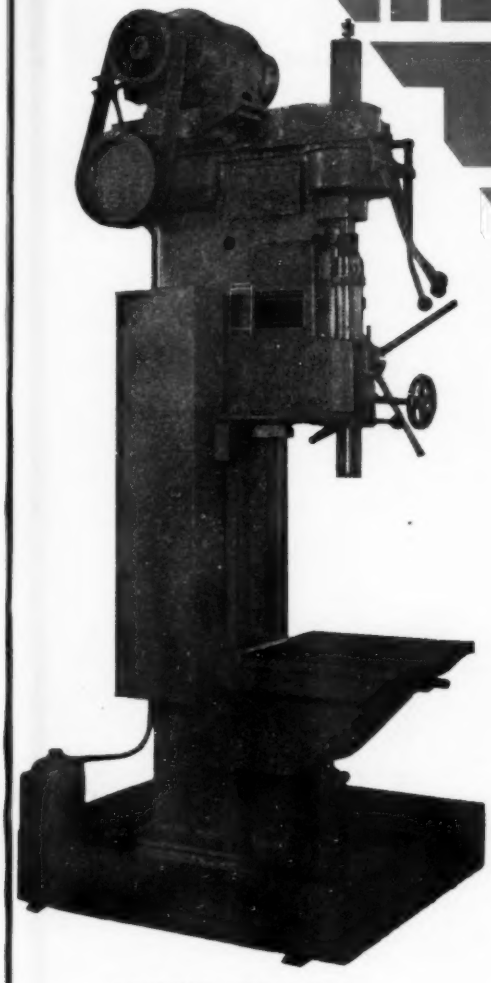
Write for descriptive literature illustrating the unusual versatility and range of this machine.

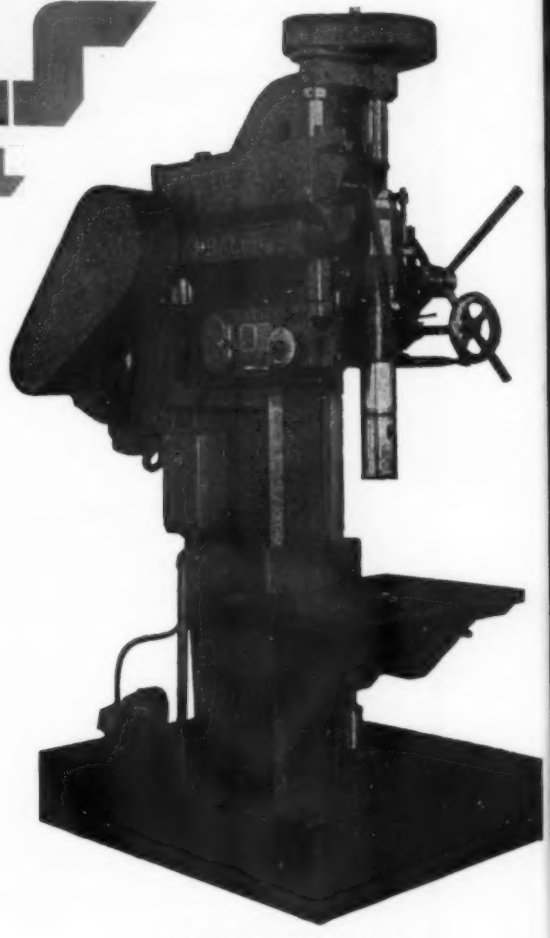
ABRASIVE MACHINE TOOL CO., EAST PROVIDENCE, R. I.

BAKER

HEAVY DUTY DRILLS

UNIVERSAL QUICK CHANGE TYPES





MODEL NO. 150

A new BAKER-built unit, designed to supplant the proved and satisfactory Model No. 121. The 150 has wider feed and speed ranges, and includes, as standard electrical equipment, a Reversing Controller . . . permits tapping with solid taps. Spindle may be reversed with convenient push button.

MODEL NO. 314-A

Another BAKER-built machine . . . has ample capacity to drive three inch diameter high speed twist drills to the limit of their efficiency in steel. The 314-A is also adapted to boring, counterboring, facing, forming and tapping operations.

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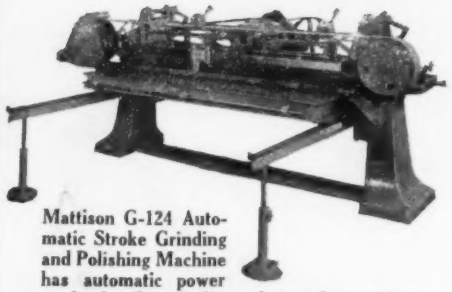
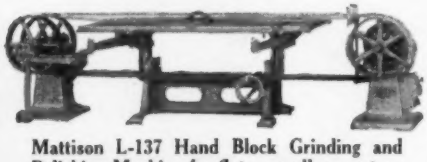
MATTISON ABRASIVE BELT GRINDING AND POLISHING MACHINES . . .



Mattison G-124 Automatic Stroke Grinding and Polishing Machine has automatic power stroke for flat grinding. It is a fast cutting machine, due to roll pressure having a point contact.

Mattison G-472 Spotting Machine is used for spot grinding steel sheets.



Mattison L-137 Hand Block Grinding and Polishing Machine for flat, as well as contour work. With shaped hand blocks, this machine will perfectly grind and polish edges of practically any contour.

★ Results obtained in a number of plants definitely establish the use of factory-coated abrasive belts as a most efficient practice. Besides reducing the number of rejections and improving the finish, they have cut the polishing cost per piece through increased production.

However, to secure full benefit from factory-coated abrasive belts, the right type of mechanical unit is necessaey. The machine is all important for properly applying the abrasive to the particular job to be done.

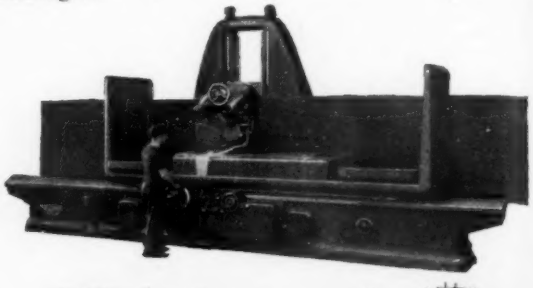
Mattison Abrasive Belt Grinding and Polishing Machines are engineered with a knowledge of the factors involved to give the best application of belts. From the time factory-coated abrasive belts were introduced for metal grinding and polishing, Mattison's have developed and built machines to provide best results.

Mattison Abrasive Belt Grinding and Polishing Machines are used for smoothing up welding marks, polishing solid parts—such as handwheels, levers, handles, steel sheets including stainless steel—and the inside of tubes. They are built for both the wet and dry grinding method. In addition to the finishing of metal parts, they are used for plastics, hardened rubber, fibre, glass, etc. In fact, the applications are so numerous, only a few can be mentioned and shown on this page.

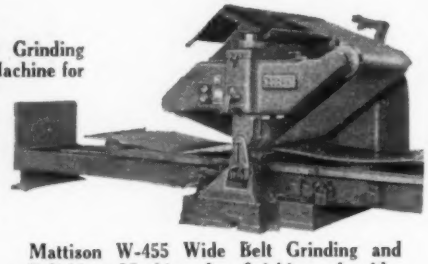
Whatever your problems may be, it is well worth while to make an investigation as to the machine available for handling it.

MATTISON GRINDING MACHINERY

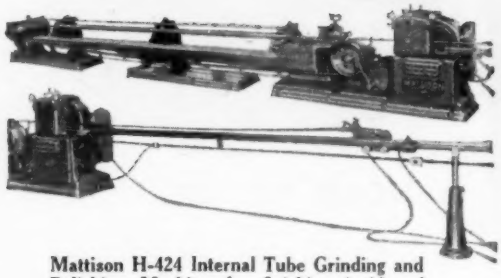
The Mattison High-Powered Precision Surface Grinder is well known throughout industry for its precision work and ability to speed production. →



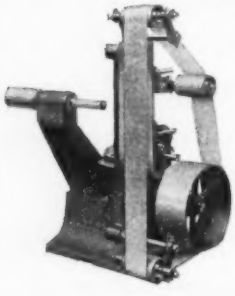
Mattison S-441 Grinding and Polishing Machine for flat and curved work. Can be furnished with or without special fixtures, depending on work ground. ←



Mattison W-455 Wide Belt Grinding and Polishing Machine for finishing of wide, stainless steel sheets.



Mattison H-424 Internal Tube Grinding and Polishing Machine for finishing inside of metal tubes.



Mattison J-115 Variety Belt Grinding and Polishing Machine for flat and curved surfaces. →

Mattison L-138 Grinding and Polishing Machine arranged for wet grinding.

Mattison J-135 Idler Stand and Pulley adapts regular polishing jack to the use of factory-coated abrasive belts. →

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COMBAT TEAM

Machines and cutting tools – this is industry's crack combat team. Only with first quality tools can you show significant results in war production!

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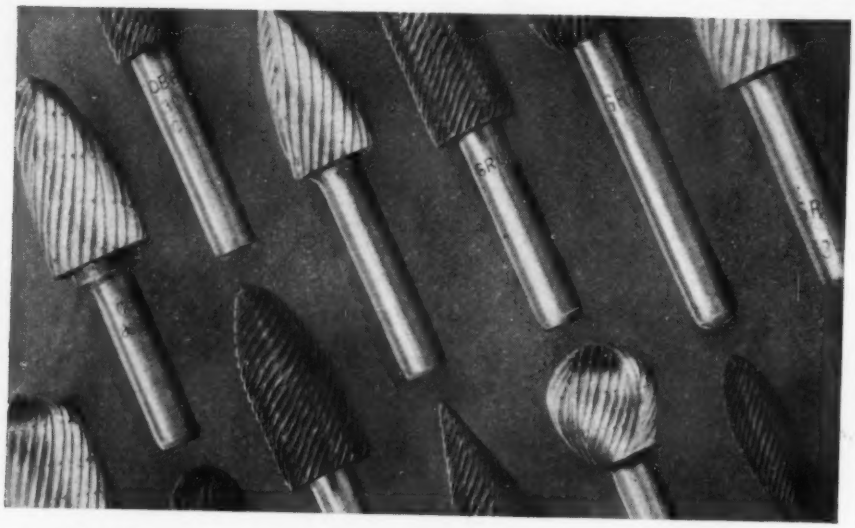

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Whether GROBET ROTARY FILES are used on hard or soft metals, or other materials, they bite hard at high speeds. Their ability to stay sharp is an accepted fact. There is a size, shape and coarseness of cut for every use.

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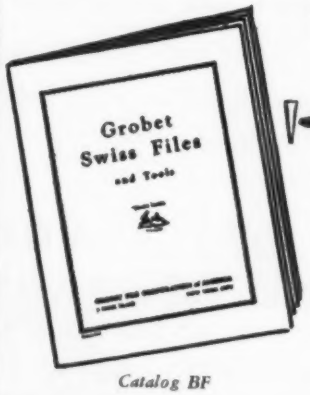
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This book shows over 5000 Grobet Precision Swiss Files

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Learn more about these quality files, made of chrome steel for higher cutting speed and durability.

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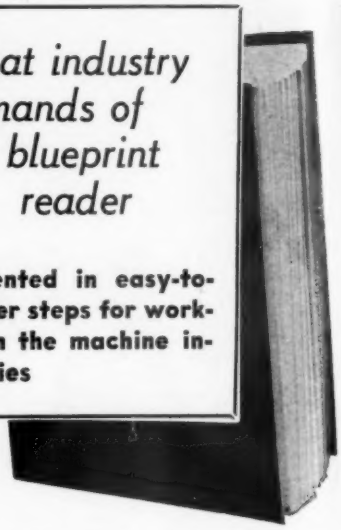
What industry demands of the blueprint reader

presented in easy-to-master steps for workers in the machine industries



HERE is a practical book designed to teach blueprint reading *quickly* and *efficiently* to men and women in industry.

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By CARLTON DWIGHT

Instructor, Vocational Department Central and North High Schools, Binghamton, New York

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YOU'LL like the simpler and more interesting approach to the study of blueprint reading offered in this book. Using material drawn from continual trial and retrial to find the best war-training methods the author presents a carefully organized treatment. No previous knowledge of blueprint reading is needed. The book introduces the learner to the subject in logical and understandable steps and provides what the learner must know in reading and interpreting blueprints on the job. You'll find it complete with questions, blueprints, and practice material—everything to be desired for quick, effective mastery of the subject.

Special features which make this book practical and workable for you

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- Permits you to work ahead by units at your own pace for easy and efficient mastery.
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More than . . . a printmaking process

WITH an Ozalid machine you make whiteprints direct from your engineering drawings in two fast steps—Exposure and Dry Development . . . the most simple method on record.

The Model B illustrated here is designed for large-scale production; turns out prints at speeds up to twenty feet per minute.

OZALID CUTS DRAFTING TIME

You can make design changes quicker with Ozalid.

Using an Ozalid transparent print of the original—it's never necessary for the draftsman to redraw any line which remains the same in the new design . . . it's never necessary to employ photographic equipment . . . or to otherwise throttle production.

Ozalid transparent prints are made in the same manner as standard prints—without Van Dyke tieups. Think what this means considering the number of design changes you're making today—the number you'll be making in the postwar period.

Be sure of a "head start" with Ozalid!

OZALID GIVES THESE EXTRA VALUES

Most Versatility

You can do much more with Ozalid. You can make prints of your engineering drawings, charts, and letters which will have blue, black, or maroon lines on a white background. You can make prints on standard, transparent, and foil materials.

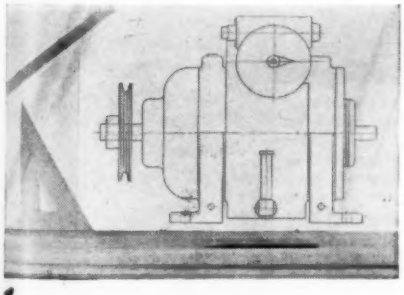
What's more—all Ozalid materials are available in cut sheets, as well as roll stock; thus, by using sheets the size of your originals you can completely eliminate trimming waste.

Low Maintenance Costs

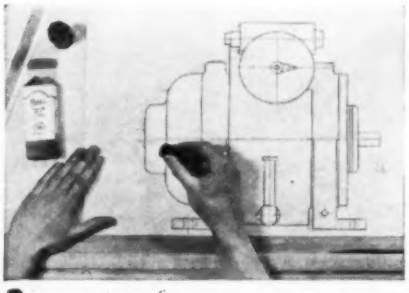
Any inexperienced person can operate an Ozalid Whiteprint Machine. There's never a labor problem, because Ozalid's Dry Development has simplified printmaking—eliminating the liquid baths, the driers, the plumbing connections which demand skilled supervision.

Another result of Ozalid's Simplified Printmaking is low electrical consumption. The Model B, operating at maximum speed, consumes only 4.4 kilowatts.

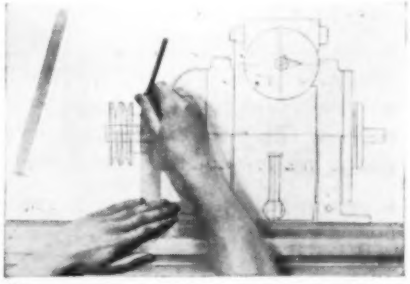
Ozalid Whiteprint Machines are designed for large-scale, medium, and occasional print production . . . and there are dry developing units for those having a suitable printer.



1. This is an Ozalid transparent print of an engineering drawing—part of which has to be changed.



2. The draftsman quickly eradicates the obsolete lines with a quick-drying corrector fluid.



3. The new design is drawn in . . . the desired number of prints can be made from this transparent copy.

OZALID PRODUCTS DIVISION

GENERAL ANILINE AND FILM CORPORATION

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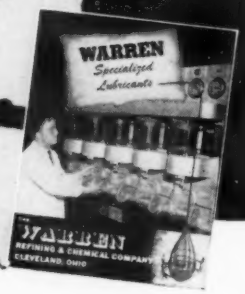

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Investigate WARCO HYDRAULIC FLUSHING OIL and WARCO HYDROIL CONCENTRATE—the products which will save time and money in cleaning contaminated systems. They completely remove gummy deposits and sludge in a few hours without dismantling pumps or valves.

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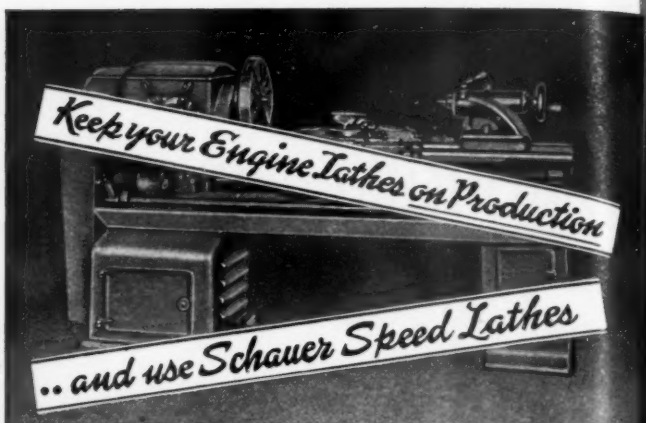

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FINISHING - POLISHING
LAPPING - BURRING
Operations of small parts

Engines lathes can be used for finishing operations on small parts—for less output and at more expense. "Keep 'em turning" . . but on machining operations.

For Finishing, Polishing, Lapping, and Burring use SCHAUER *Speed Lathes* - easy to operate - your choice of spindle speeds from 25 to 5000 rpm's. We have all types of **standard** Speed Lathes to meet your individual requirements.

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351—Straight Sleeves with Morse Taper Holes
TANG END TYPE
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351—B. & S. Taper Sleeves with B. & S. Holes
356—Morse Taper Sleeves with B. & S. Taper Holes
358—B. & S. Taper Sleeves with Morse Taper Holes
TAPPED END FOR DRAW BAR
352—B. & S. Taper Sleeves with B. & S. Taper Holes
359—B. & S. Taper Sleeves with Morse Taper Holes
EXTENSION TYPE
354—Morse Taper Extension Sleeves with Morse Taper Holes

ON THE LEFT is illustrated an ordinary soft steel sleeve; on the right a Midwest Hardened and Ground Sleeve. Because Midwest Sleeves are scientifically hardened and precision ground, their length of accurate life is ten to twenty times longer than ordinary soft steel sleeves.

Furthermore, the longer life of Midwest Sleeves saves vital steels—steels otherwise consumed by repeatedly replacing soft sleeves which quickly become worn, marred and discarded.

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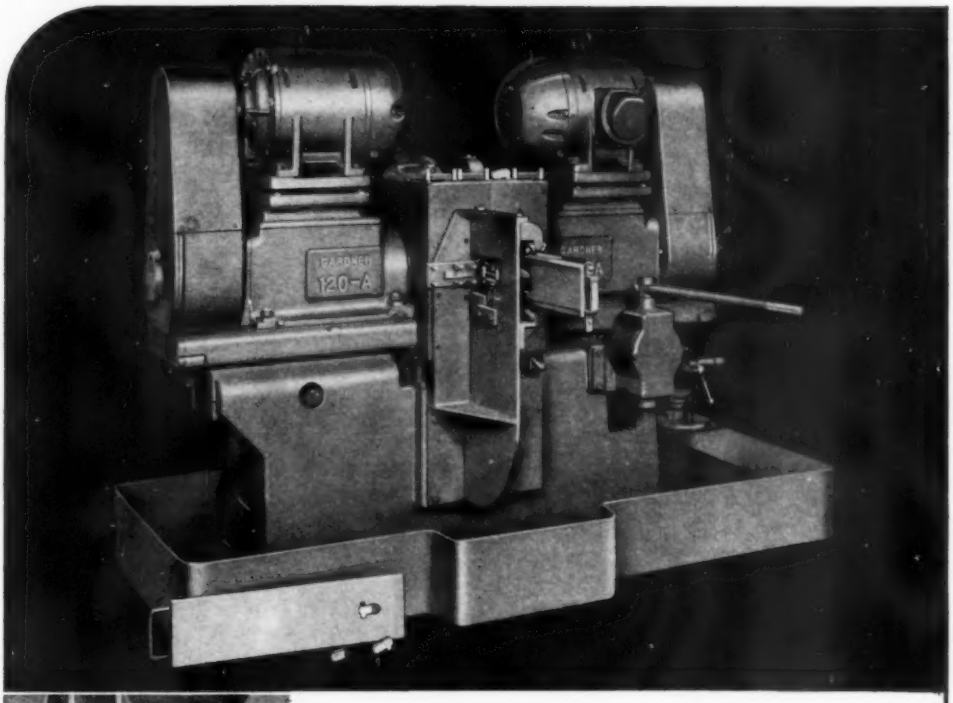
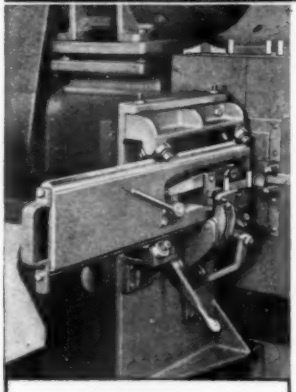
MIDWEST TOOL & MFG. CO., 2356 W. JEFFERSON AVE., DETROIT, MICH.

"Back-to-back" grinding *on this* GARDNER DOUBLE GRINDER





A *Modern* GARDNER WIRE-LOKT ABRASIVE

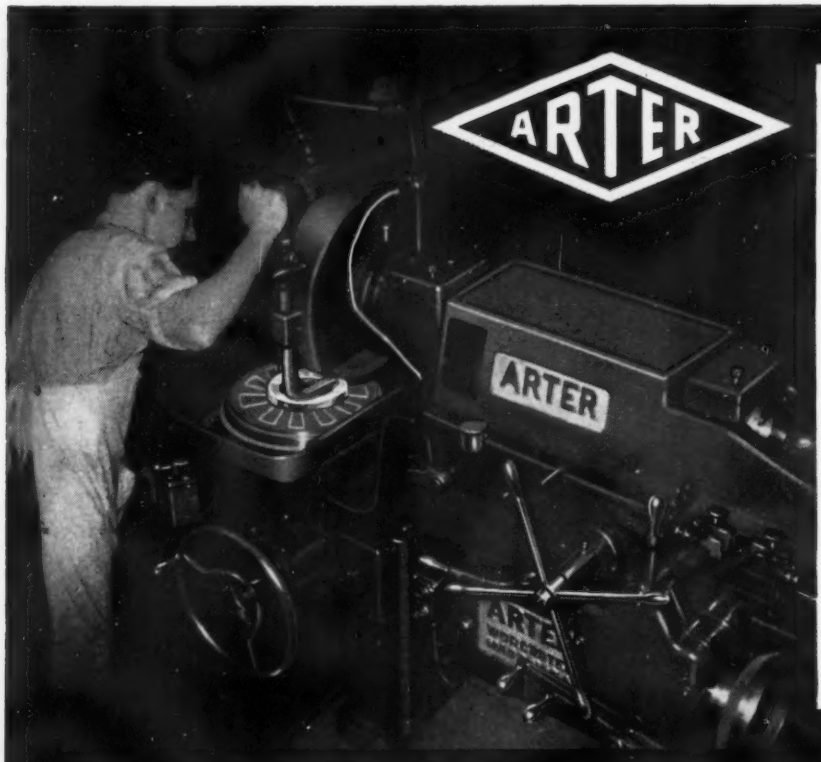
IN CONTRAST to the customary parallel-surface work generally handled on Gardner Double Grinders, here is an unusual fixturing job which enables ONE surface of TWO duplicate parts, to be ground in one setting.

Carriage clamps, made of steel, are ground on this No. 120A-20" Gardner Grinder in a roller gun-type sliding fixture. A piece is carried in each side of a double fixture, giving a "back-to-back" arrangement, and a locating guide and hand-operated clamping mechanism, fixtures the parts quickly.

PRODUCTION: 2 to 4 pieces per minute, with the ground pads held within .005" for size.

Ask for data on this GARDNER DOUBLE GRINDER

GARDNER MACHINE COMPANY
410 East Gardner Street » » » » Beloit, Wisconsin, U. S. A.

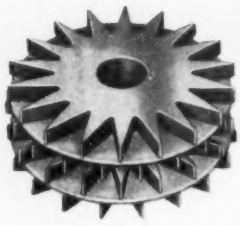


Precision grinding for aircraft — supremely important is a fine criterion for surface grinding—and this thrust bearing ring is a typical example of the wide scope and versatility of ARTER GRINDERS. Innumerable aircraft engine parts are ground rapidly to close tolerances by ARTER ROTARY SURFACE GRINDERS.

ARTER GRINDING MACHINE COMPANY

ARMY E NAVY

WORCESTER, MASSACHUSETTS • U. S. A.



DESMOND

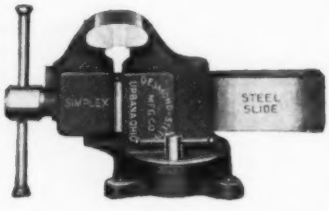
GRINDING WHEEL DRESSERS & CUTTERS

We manufacture a complete line of wheel truing tools and can supply the proper dresser for each of your grinding wheels.

SIMPLEX

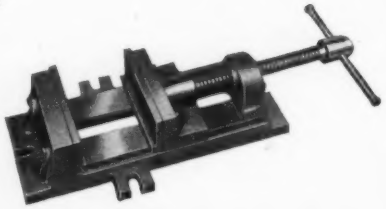
Steel Slide

VISES



A full line of Machinists, Welders, Filers, Production and Drill Press & Milling Machine Vises with solid steel slides.

Write for copy of catalog "A" and name of your nearest dealer who can supply you.



THE DESMOND-STEPHAN MFG. CO.

URBANA, OHIO

STANDARD

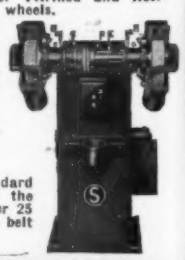
Multiple Grinders

A MULTIPLE SPEED GRINDER FOR MULTIPLE ECONOMY. Peripheral speed is maintained, thus increasing production. Wheel stubs from larger wheels, formerly discarded, may be transferred to this Grinder.

Outstanding Advantages Include:

Safety type hinge door exhaust guards, adjustable to wheel wear. Interlocking arrangement prevents over-speeding of grinding wheels. Push button starting. Available in wheel sizes, 10" to 30" diameter. Suitable for Vitrified and Resinoid bond wheels.

Adapted for Resinoid or Vitrified Wheels

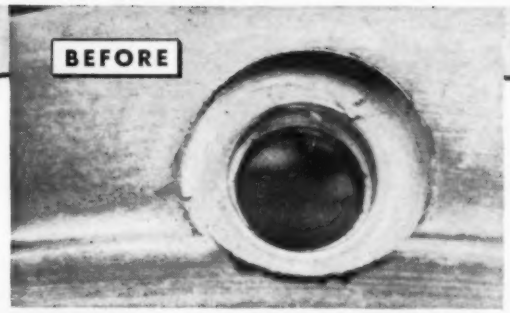


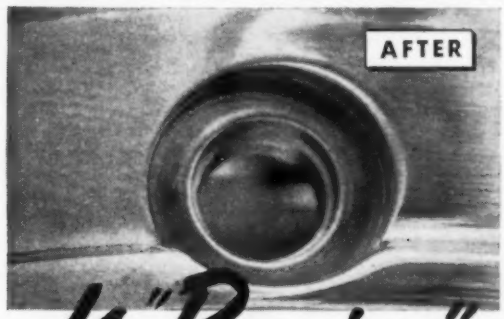
This Multi-Speed Standard Grinder operates with the same efficiency at either 25 or 60 cycles through its belt drive.

Write for Catalog No. 43. Prices, specify voltage, phase, cycles.

The STANDARD ELECTRICAL TOOL Co.

2490 River Road CINCINNATI • OHIO





If "Burring"

IS YOUR PRODUCTION ENEMY No. 1—

Let Osborn Prove To You How Brushes Can Speed and Improve This Operation

● The illustrations above show a section of a precision metal part used in a vital wartime product. Top photograph is a close-up view of one edge of this part. What looks like a mountain range around the hole are really small burrs. Below it this same area is pictured after brushing. Note the absence of any excess metal, the smooth finish and the rounded corners.

This example is typical of thousands of metal parts, large and small, going into the production of such precision products as bombs, shells, guns, recoil mechanisms and motors. Every one must be free of burrs. Every one must have the corners broken. Too frequently, both operations are being performed by slow, inefficient manual methods, with the result that an abnormal number of workers is required for this service and the finished job leaves much to be desired.

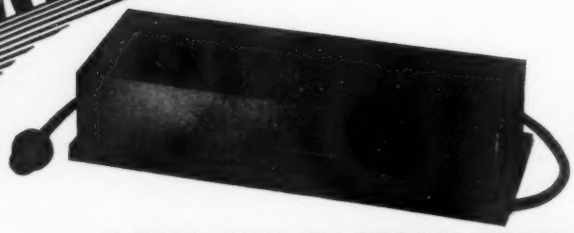
Osborn representatives are prepared to study your burring requirements and show you how the right type or types of power-driven brushes, properly applied, can speed, simplify and improve this all-important operation. Write today for complete information. *The Osborn Manufacturing Company, 5401 Hamilton Avenue, Cleveland, Ohio.*

Osborn Brushes

WORLD'S LARGEST MANUFACTURER OF BRUSHES FOR INDUSTRY

WALKER MAGNETIC CHUCKS

Style B Face Plate—in standard diameters from 10⅜" to 36⅞" inclusive.



No. 617 Bar Pole Face Rectangular Magnetic Chuck.

DEMAGNETIZERS

Walker DEMAGNETIZERS are available in standard D.C. and A.C. types for either 110 or 220 v. Ask for Bulletin K7 giving detailed specifications.

A FULL LINE OF PROVED STANDARD DESIGNS

Walker offers prompt and complete service on magnetic chucks by carrying in stock a considerable line of Rectangular and Rotary types for use on all surface and internal grinding machines built by American machine tool manufacturers. These units—for grinding, milling, planing and turning operations—are of proved design and are available in such a complete range of sizes as to enable you to select standard units for practically any chucking problem. Write for bulletin W4 giving detailed information.

Also special CHUCKS *for special* NEEDS

The design of Walker Magnetic Chucks is such that "specials" can be developed and furnished at prices only slightly more than standard units. If you require special magnetic chucks for special purposes, consult Walker and be assured of prompt, economical service.

O. S. WALKER CO., INC.
WORCESTER, MASS.

Boyar-Schultz PROFILE GRINDER No. 1

ITS first popularity was earned in the tool and die shop where it saved many hours in grinding and fitting irregularly curved contours and profiles so frequently found in tool and die work.

Boyar-Schultz Profile Grinder No. 1 has since been found to be equally efficient in production work where similar grinding problems must be solved quickly.

The spindle, operating at the high speed of 20,000 R.P.M. permits the use of small diameter wheels in confined openings and small radii. It is the type of machine tool that soon pays for itself in time saved.

Circular Mailed on Request

BOYAR-SCHULTZ CORPORATION
2108-H Walnut Street **CHICAGO, ILL.**

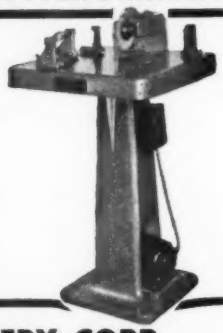
The BARNES PRECISION CUTTER GRINDER

Grinds any profile desired with SPEED and ACCURACY

Regardless of how complicated or irregular the gang or cutter, the "Barnes" will grind it to the exact form desired with an accuracy that leaves nothing to be desired.

The speed and savings assured by this machine are available without any need to change existing cutter equipment. With the Barnes Precision Cutter Grinder the use of profile ground formed cutters is made possible thereby assuring the production of the high quality and quantity of work for which this type of cutter is so well known.

Write for Descriptive Circular



GENERAL MACHINERY CORP.
140 Federal St. **Boston, Mass.**

Carbide and Diamond-tipped
GAGES AND TOOLS
GUARANTEED QUALITY

ARTHUR A. *Crafts* COMPANY, INC.
Chicago 532 COMMONWEALTH AVE. *Detroit*
Boston

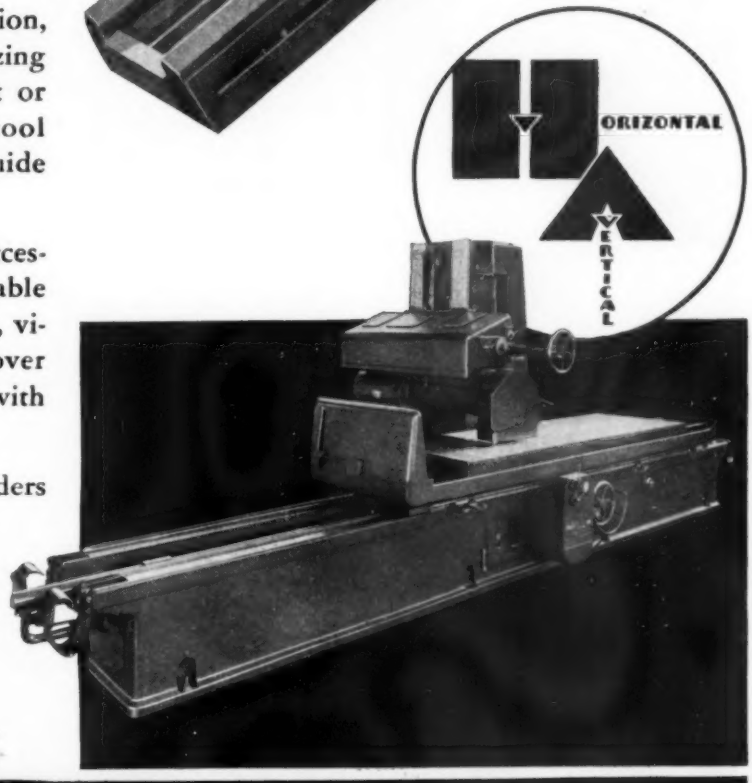
from 1½ ounces to 3½ tons

The HILL "Open Side" Horizontal Spindle Surface Grinder will produce a finished surface on a small key or a large casting to exacting tolerances

Here is a Heavy Duty, Hydraulic, Precision, Surface Grinder that demonstrates amazing versatility and accuracy in finishing flat or irregular surfaces such as machine tool ways, dies, links, plates, die blocks, guide bars, cams, etc.

"Open Side" design affords maximum accessibility to the work — Fully hydraulic table and cross feeds insure smooth, positive, vibrationless operation. Proven savings over previous methods run as high as 90% with corresponding increases in production.

HILL "Open Side" Hydraulic Surface Grinders are built in both Horizontal Spindle and Vertical Spindle design and in varying table sizes to accommodate all classes of work within the scope of this type of machine. Bulletin HV-3 gives complete details.



The HILL ACME Co.

6400 BREAKWATER AVE • CLEVELAND, OHIO

For SURFACE GRINDING

This 846 K-1 Dayton Grinding Wheel is Doing a Whale of a Job for Hundreds of Users.

Example No. 1. Surfacing mild steel on hydraulic grinder—giving maximum stock removal with a minimum of wheel wear.

Example No. 2. Precision grinding of hardened steel parts—with high production efficiency and giving excellent finish.

Example No. 3. Many users of this wheel have found it ideal for surfacing varied materials, saving time usually required to change wheels.

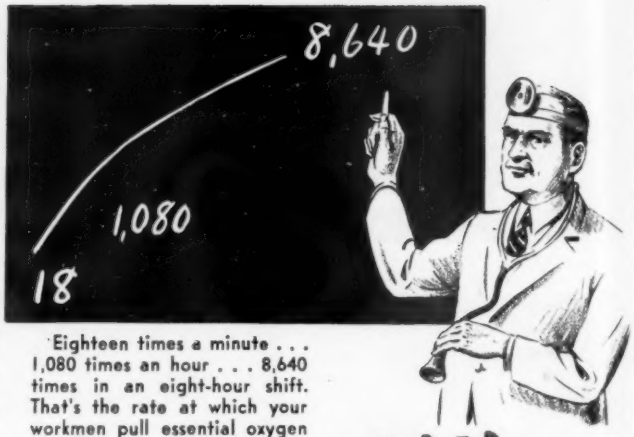
If you have a problem in surfacing or any other grinding that you haven't solved to your complete satisfaction, we may have the answer.

Write, wire, or phone—giving us an outline of your problem—and one of our experienced engineers will serve you promptly and efficiently. We may have what you need in stock.

Dayton Grinding Wheels

Simonds Worden White Company

712 Negley Place, Dayton, Ohio



Eighteen times a minute . . . 1,080 times an hour . . . 8,640 times in an eight-hour shift. That's the rate at which your workmen pull essential oxygen into their lungs. Is it clean air they're breathing or is it fouled with abrasive grit and dust from grinders and buffers?

You can find the right answer to this question and check off a menace to employees' health by trapping grit and dust at their source with the Cincinnati Air Master.

The Air Master is easily installed, easily cleaned and built in three sizes to fit all grinders and buffers. Write for complete information.

The Cincinnati

ELECTRIC DRILLS • GRINDERS • BUFFERS • PORTABLE TOOLS

The Cincinnati Electrical Tool Co.

DIVISION OF THE R. K. LEBLOND MACHINE TOOL CO., CINCINNATI, OHIO

2676 MADISON RD.

Demand these labels when buying uniforms

ARMY TWILL BY REEVES REG. U.S. PAT. OFF. SANFORIZED* MADE TO GOVERNMENT SPECIFICATIONS

REEVES Glengarrie POPLIN

UNIFORMS OF REEVES ARMY TWILL CAN TAKE IT!

Men who handle machinery demand work uniforms that withstand heavy strain. So specify *Reeves* famous fabrics when ordering *your* uniforms.

Uniforms made of Reeves Army Twill meet exacting U. S. Government Tests for better wear, longer life, color fastness. Its fabric vitality keeps "in shape."

GLENGARRIE POPLIN for matching shirts. A durable, stylish fabric that comes in a wide range of colors. Both fabrics are Sanforized* against shrinking.

*Fabric shrinkage not more than 1%. (U. S. Government Test CCC. T-191-a.

See your nearest dealer for uniforms, sport and work clothes made from these famous fabrics, or write for leaflet to:

OVER 6050 million yards of Reeves Army Twill sold to the U.S. Army

REEVES BROTHERS, INC.

54 WORTH STREET NEW YORK

A flexible machine that is the last word in simplicity of operation

HI-SPEED
HONING and LAPPING MACHINE

for use with any standard make honing head

Illustrated is No. 0 Machine equipped for 36" stroke with 80" under the spindle.

HONES CYLINDERS up to 24" in diameter . . . with STROKES from 20" to 72" . . .

IDEAL FOR PRODUCTION JOBS INVOLVING:

Aircraft parts . . . Ordnance parts . . . Diesel engines . . . Compressors . . . Pumps . . . Internal combustion engines . . . Steam cylinders, etc.

Speed up war work involving internal cylindrical surfaces by utilizing a HI-SPEED Honing Machine. When used with proper honing head of any standard make, the HI-SPEED machine produces accurate, straight, round, smooth bores—amazingly fast.

Unique positive stop and dwell system makes it possible to stop the spindle without shock or impact at the bottom of each stroke, at any point within the stroke range and hold the spindle without reciprocation, at that point up to 1½ minutes. Ideal for "blind hole" honing and straight line lapping or honing.

All controls are located at the front of the machine at the operator's station . . . No ladders to climb . . . Stroke setting, hone withdrawal, short stroking at any point, changes in speed of reciprocation or rotation of the spindle made instantly from operator's station.

The HI-SPEED Honing Machine is made in 4 sizes, any one of which can be had with strokes up to 72"... Designed for use with any standard make of honing head.

Tell us your requirements—and our engineers will promptly furnish you with complete information, prices and early delivery dates.

NOTE THESE SPECIFICATIONS:

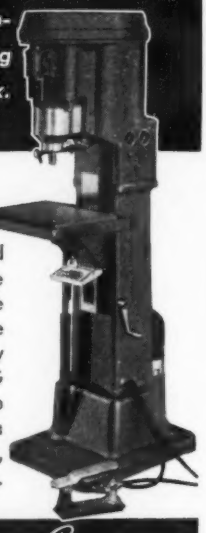
Model No.	No. 0	No. 1	No. 2	No. 3
Stroke (standard)	20"	36"	48"	72"
Working Base Area (standard) .. Auxiliary Tables available	21" x 22"	31" x 31"	31" x 31"	48" x 54"
Height Under Spindle Nose (up) .. Added Height Available on Order.	48"	60"	75"	100"
Spindle Diameter	2¼"	2½"	2½"	2¾"
Spindle Speeds Through Gear Box	4	4	4	8
Main Drive Motor (standard)	7½ hp	10 hp	15 hp	20 hp
Coolant Pump Volume, Motor Driven	14 gpm	18 gpm	18 gpm	25 gpm
Maximum Bore possible to hone with standard spindle drive motor ..	10" Dia.	12" Dia.	16" Dia.	20" Dia.
Maximum Overall Diameter of Cylinder possible to place on standard base	18"	27"	27"	44"
Floor Area	44" x 60"	60" x 80"	60" x 80"	60" x 108"
Overall Height	11'6"	15'3"	18'3"	23'8"

NOTE: Under our new policy of distribution, sales territories are being assigned to financially responsible, established dealers in the machine tool field. A few excellent territories are still open, and dealers are cordially invited to write us relative to sales representation.

AUTOMOTIVE MAINTENANCE MACHINERY CO.
2100 Commonwealth Avenue, North Chicago, Illinois

New Fixture Acclaimed by Production Men!

Piece-Part Control speeds up tapping operation — provides amazing control over accuracy of work.



The part and the machine do the "thinking." Air does the work! Operator has only to feed parts. With both hands free —with no need to use the foot pedal—operator can turn out more work—faster and better—than by any other method. Full details in TAPPING TIPS—new literature devoted largely to critical war work. Write for a copy. R. G. Haskins Company, 2761 W. Flournoy St., Chicago.

HASKINS *Precision* TAPPING EQUIPMENT

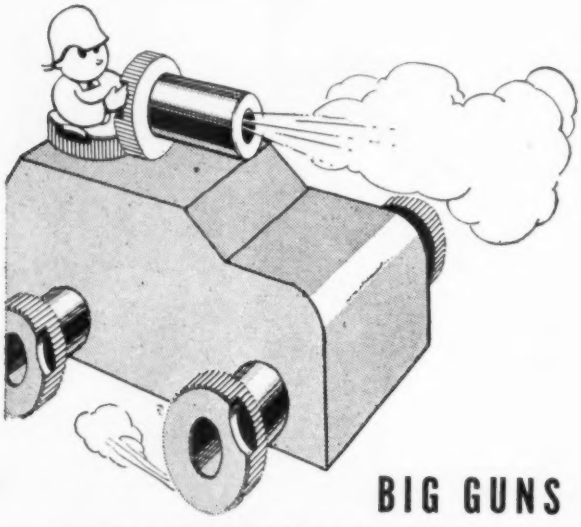
The Original Manufacturers of Drill Chucks

The Almond Three-Jaw Drill Chucks were the first to be placed on the market. They were Pioneers in the field of Drill Chucks. For over seventy years Almond Chucks have formed a necessary part in the logical procedure of machine developments. Are made in types and sizes to fit all machine tools and portable drills.

Write for further information

Almond Drill Chuck

T. R. ALMOND MFG. CO.
ASHBURNHAM, MASS., U. S. A.



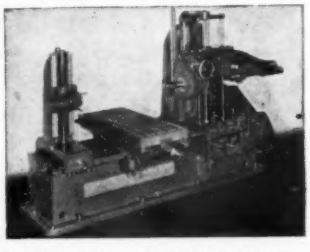
BIG GUNS FOR DRILLING HOLES

They're mighty small compared to a gun or a General Grant, but in building jigs for the manufacture of gun and tank parts or any other precision metal part it pays to use Universal Drill Bushings. Because of their straight and round superfinished bores, Universal Bushings save tools, wear longer and assure accuracy. Write for complete facts.

UNIVERSAL ENGINEERING CO.
FRANKENMUTH - MICHIGAN

UNIVERSAL *Horizontal Boring Machine*
The only TRIWAY *Boring Machine Built*

Made in 3" and 4" spindle sizes. Write for complete, detailed specifications.



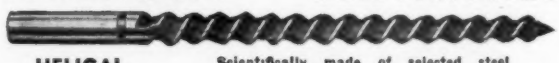
Standard Universal 3" Spindle Machine

UNIVERSAL BORING MACHINE CO.
Hudson, Mass., U. S. A.

LELAND-GIFFORD COMPANY · WORCESTER MASS. U.S.A. · MACHINE TOOLS · CRANK SHAFTS

Drilling and Tapping Machines
(Automatic and Semi-Automatic)
LELAND GIFFORD CO.
WORCESTER, MASS.

HOLMAN *BETTER, FASTER HOLE FINISHING*



HELICAL TAPER PIN REAMERS

Scientifically made of selected steel under modern processes. Long lived, economical, accurate. Details on request.

HOLMAN REAMER CO.
MANCHESTER, CONN.

AWARDED TO REPUBLIC DRILL AND TOOL...

"For Great Accomplishment in the Production of War Equipment"

THESE ARE TIMES when young and vigorous companies grow swiftly to maturity in the service of their country.

An "acorn" of industry in 1940, Republic Drill and Tool has grown into a mighty oak in its field, with an "E" Award that will spur its growth to new heights for victory.

In conferring the Award, Undersecretary of War Robert Patterson said: "For great accomplishment in the production of war equipment, this symbolizes your country's appreciation of the achievement of every man and woman in your plant. . . . I am confident that your outstanding record will bring victory nearer by inspiring others to similar high achievement."

The ability to deliver—on time—essential products of high quality in large quantity, has made Republic Drill and Tool one of America's largest manufacturers of high speed twist drills.

Republic's advanced conceptions, methods and machines have greatly increased production of these vital tools, so necessary in the manufacture of *all* war equipment using metal or plastics.

Today, we shall supply with ever greater zeal the needs of those who use our products for war. Tomorrow, our skill and experience will supply their needs in making the products of peace for a new free world.

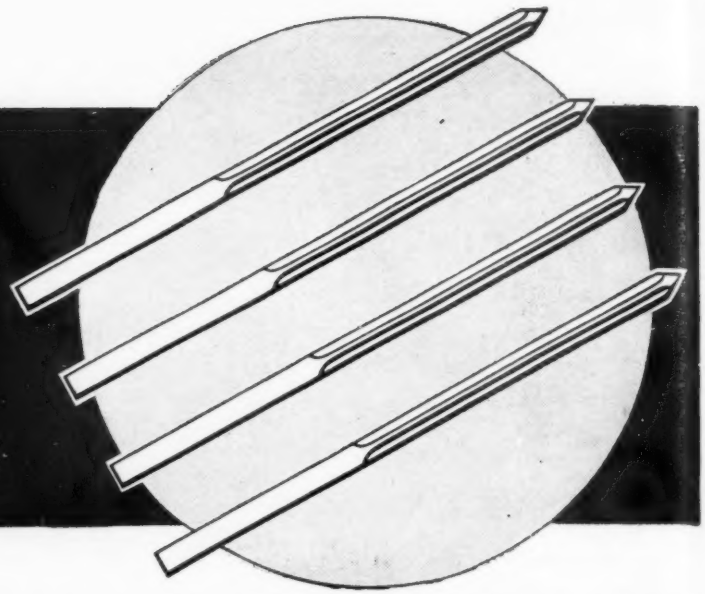
REPUBLIC DRILL AND TOOL COMPANY

Makers of CENTURY and FEDERAL High Speed Drills

322 South Green Street, Chicago, Illinois

In Republic's two plants shown above, 1800 workers are turning out millions of High Speed Twist Drills every month.

L & I
Small, Hi-speed REAMERS with Ground Flutes



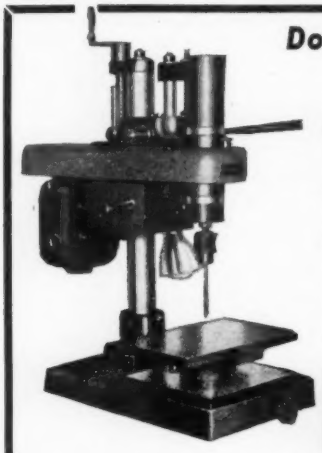
for smoother finishing and higher precision in small hole production

A finer, keener cutting edge is assured by L & I Reamers because in the manufacturing process flutes are ground in *after hardening*, and carefully lapped. Distortion of flute structure, often occurring after heat-treating of small, fluted-flute reamers, is definitely eliminated.

If you are concerned with getting smoother surface finish and closer tolerances in small holes, long-lived, precision L & I Reamers are the tools to use. Standard sizes 1/16" to 1/4" diameter as well as "specials" are available for prompt delivery.

Send for Descriptive Circular giving specifications and prices

LAVALLEE & IDE, INC., CHICOPEE, MASS.



Do your sensitive drilling on a

MAXI-JR-E

● Here is a high production unit for small holes from .004" to .250" diameter. Sturdy — smooth — fast —it is a self contained unit with 8 inch vertical adjustment on column. Drilling unit overhang from center of chuck to column 5". Vertical capacity 10". Available in spindle speeds from 750 to 12,000 r.p.m. Write for bulletin.

The Hamilton Tool Co.
HAMILTON OHIO

LUCAS "PRECISION"
Horizontal Boring, Drilling and Milling Machine
THE LUCAS MACHINE TOOL CO.

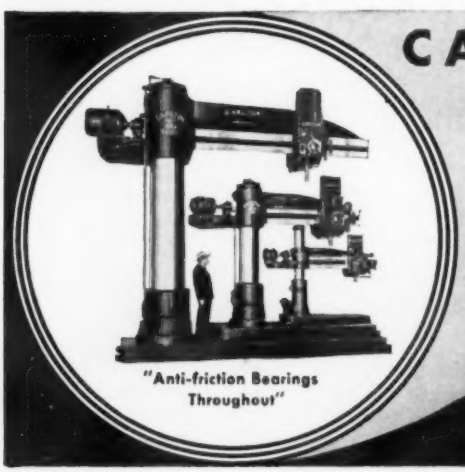
NOW AND ALWAYS OF

CLEVELAND
OHIO, U. S. A.

BARNESDRIL
HONERS . . . DRILLERS

Write Today for Catalog A

BARNES DRILL CO.
830 CHESTNUT STREET ROCKFORD, ILLINOIS



"Anti-friction Bearings Throughout"

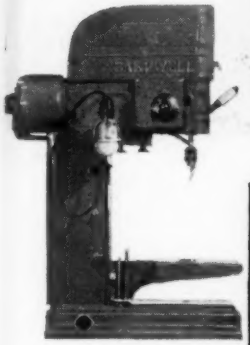
CARLTON RADIAL DRILL

FEATURES — 1. Low Hung Drive to the Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all speeds. 4. Concentrated and Convenient controls. 5. Constructed on Unit Principal.

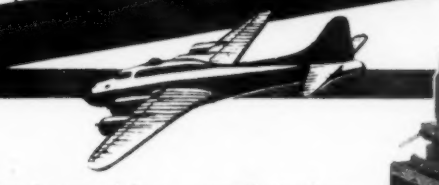
The CARLTON
MACHINE TOOL COMPANY
CINCINNATI, OHIO, U. S. A.

ARMY E NAVY

Regardless of thread size or class fit... there's a BAKEWELL TAPPING MACHINE for the job



The No. 0 bench model for No. 0-80 to 8-32 capacity in steels



Where there's precision manufacturing of aircraft motors, parts, units and accessories, even the big 4-foot wing struts... you'll find Bakewell Precision Tapping Machines.

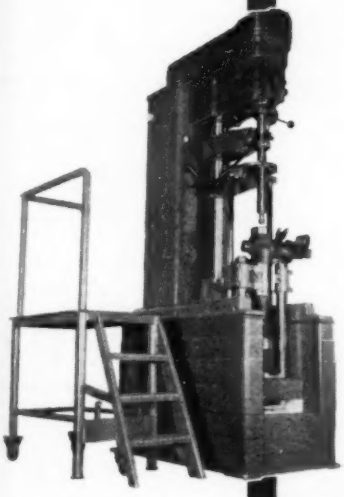
Tapping to Class 3 and 4 gage fits with a single pass, the Bakewell Tapper is accomplishing much toward making aircraft production history.

Bakewell Tapping Machines are beating production schedules. They are eliminating costly rejects, saving invaluable time and critical materials. The patented lead screw and electric guide finger feed, the automatic clutch, the precision limit control, the double speed reversing motor... all are factors that help make the Bakewell Tapping Machine outstanding in the aircraft industry.

If you have tapping troubles write or wire for full information. Regardless of your precision tapping need, there is a Bakewell that will meet it.

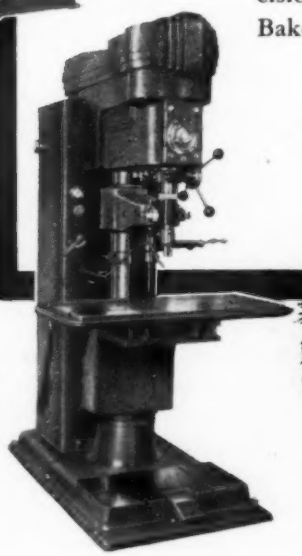
PROMPT DELIVERIES
ON ALL STOCK MODELS

For large and bulky pieces of work the Bakewell Radial model is recommended.



Specially designed and built for tapping airplane wing struts...

The No. 1 model has a tapping capacity of 8-32 to ⅝" in steels.

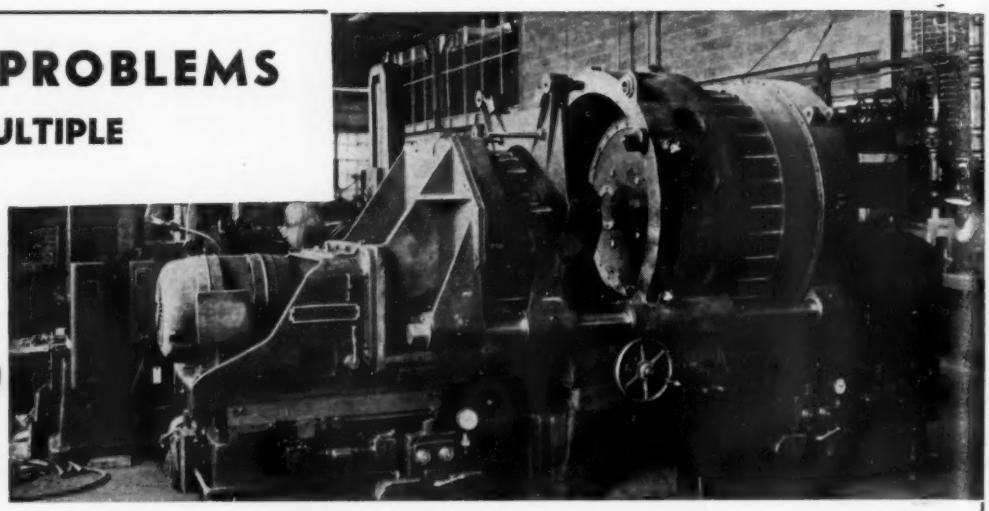


Bakewell Tapping Machine #2. Capacity: ⅜" to 1½" in steels and 2½" in aluminum, bronze, plastics or other soft materials.

Bakewell
MANUFACTURING CO.
2023 SANTA FE AVE., LOS ANGELES, CALIF.

ARMY E NAVY

SOLVING PROBLEMS INVOLVING MULTIPLE SPINDLE OPERATIONS A Buhr SPECIALTY



Note This One

Tooling consists of a fixture for clamping an anti-aircraft part of which one side is a bushing plate. Right hand head has 82-spindles, and Left hand head has 38 spindles with a sliding bushing plate for removal of part from fixture.

All spindles have vertical adjustment for drill adjustment. An oil pump is provided in each head to insure positive lubrication to all ball bearings in the head.

These heads are direct motor driven and mounted on ways and are moved in and out by hydraulic cylinders.

If you have a production problem, let Buhr engineers help you.

BUHR MACHINE TOOL COMPANY, Ann Arbor, Mich.

Specialists in Multiple Spindle Drilling, Boring, Reaming, Tapping Equipment

★ HOBS ★ REAMERS ★ COUNTERBORES
★ GEAR SHAPER CUTTERS ★ BROACHES ★ CIRCULAR AND FLAT FORM TOOLS
★ SLITTING SAWS ★ GEAR CUTTERS
★ SPECIAL TOOLS ★ MILLING CUTTERS

NATIONAL Tools CLEVELAND

Definition of Precision

Precision– Noun. Exactness, accuracy.

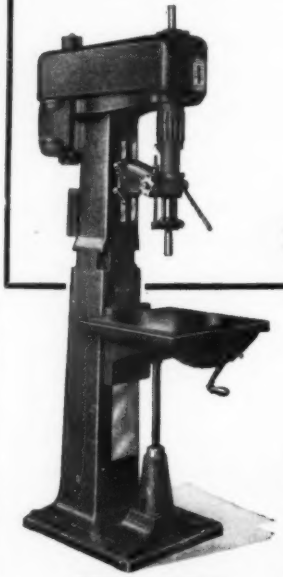
Example– National Cleveland Tools are made with the exactness that enables them to meet present-day demands for accuracy.

ARMY E NAVY

NATIONAL TOOLS HAVE AN INTERNATIONAL REPUTATION

The NATIONAL TOOL Co.

[illegible] MADISON AVENUE CLEVELAND OHIO



TYPE 50 HIGH SPEED *Full Ball Bearing* REED *Variable Speed* SENSITIVE DRILLS

Infinite speeds from 440 to 3000 RPM instantly available

Famous REED high quality is featured in these new streamlined, efficient safe and easily operated machines.

Variable speed drive, controlled by hand wheel gives infinite speed range. An indicator shows spindle speeds at all times. Utmost safety is assured because the only exposed moving part is the drill chuck.

Made in any number of spindles up to and including 4. On multiple spindle units each spindle is provided with a separate motor and drive. These machines are ideal for high speed, precision drilling operations.

SPECIFICATIONS

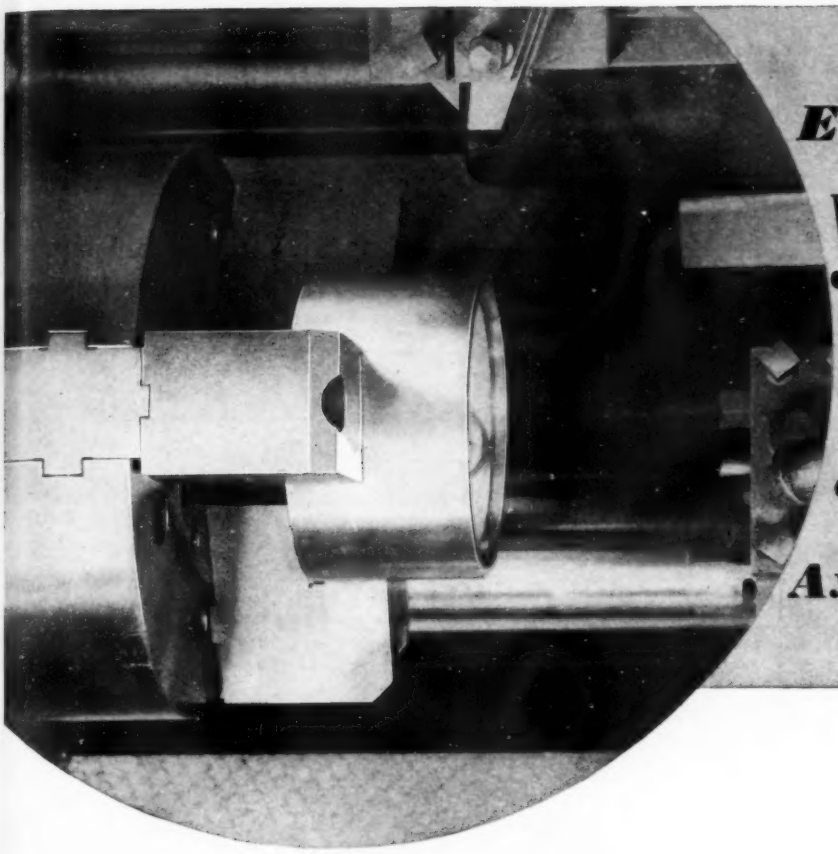
Capacity ¾"
Spindle Travel 6"
Adjustment of Head 6½"
Range Adjustment of Table 12"
Center Spindle to Column 8¼"
Max. distance spindle nose to table 26"
Motor ¾ H.P. Ball Bearings

Write for complete, detailed specifications

PRODUCTION MACHINE CO.

Manufacturers of Drilling Machines, Tool Grinders and Head and Automatic Polishing and Grinding Machines.

GREENFIELD, MASS., U. S. A.



Every time you close these jaws *our grip on the Axis grows tighter*

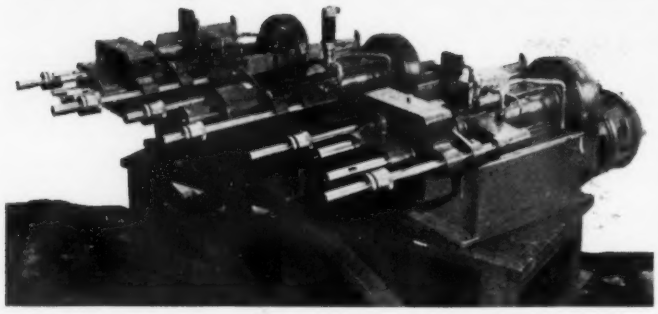
● Every gun . . . every tank . . . every plane . . . every rifle and truck, bombsight and bomb, ship and torpedo . . . that goes out of America's arsenals to speed our victory, very largely consists of parts that were formed in the jaws of chucks. No piece of production equipment is more directly engaged in the "front line battle". Therefore we say to Cushman Chuck users . . . get the last ounce of efficient productive effort out of your chucking equipment. Let us help you make sure that the correct types are used to handle each job most efficiently. Make sure that your operators follow simple maintenance rules that prolong chuck life and assure accuracy. Help us speed your deliveries of needed new chucks by correct specifications in ordering, by anticipating your needs as far in advance as possible and by furnishing suitable priorities. We will be glad to send you copies of the Cushman Catalog and Data Book, also supplies of "Chuck Check" maintenance cards on request. The Cushman Chuck Company, Hartford, Conn.

CUSHMAN

A World Standard for PRECISION

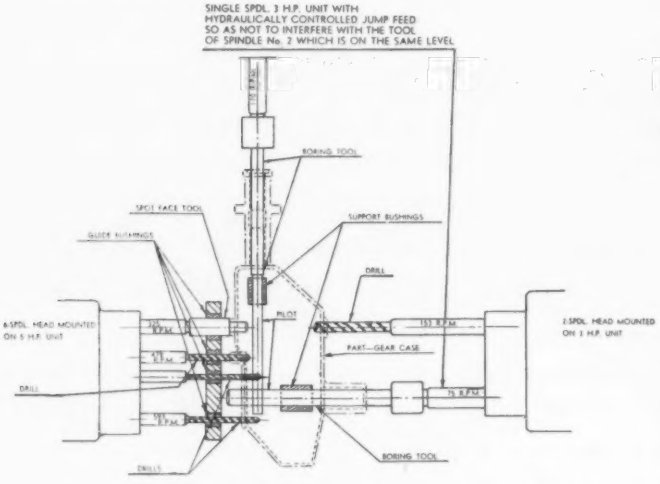
These small "Chuck Check" maintenance cards can be given to operators or put on bulletin boards. They'll help save time, save chucks and reduce spoilage. Ask us to send you some.

9 HOLES MACHINED IN GEAR CASE in one-eighth former time...



● Three 5 h.p. units designed in connection with heads on a machine built by customer who provided fixture and base for machining a case from 3 sides with electrical control so arranged that no interference of any one unit with any other can take place. The adjustable stop collars on the guide bars control depth of facing, holding uniformity. Center unit equipped with speed reducer to accommodate large facing cutter.

● Details of machining operation on cast iron gear case. Operation was set up so that spindles did not interfere even though they were on the same plane.


SINGLE SPDL. 3 H.P. UNIT WITH HYDRAULICALLY CONTROLLED JUMP FEED SO AS NOT TO INTERFERE WITH THE TOOL OF SPINDLE No. 2 WHICH IS ON THE SAME LEVEL
BORING TOOL
SPOT FACE TOOL
SUPPORT BUSHINGS
GUIDE BUSHINGS
DRILL
PILOT
6-SPDL. HEAD MOUNTED ON 5 H.P. UNIT
3-SPDL. HEAD MOUNTED ON 3 H.P. UNIT
PART—GEAR CASE
DRILL
BORING TOOL

★ A single spindle, a double spindle, and a six spindle head for drilling, facing, boring, and reaming a cast iron gear case.

With these heads it required one minute to machine 9 holes ranging from 33/64" to 2½" in diameter. Once the case was put in the fixture no handling time was required.

This combination of Hoefer Heads was designed to do a job formerly requiring special machines which at the time were not available. The design enabled machining time to be reduced to ⅛ the time formerly required for the same operation.

In planning your future machining and in figuring for lowest cost machine investment consult with us.

HOEFER'S WHOLE BUSINESS IS HOLES

HOEFER MFG. CO. *Freeport, Ill.*

SIGOURNEY M-100

A NEW HIGH SPEED SENSITIVE DRILLING MACHINE

Ruggedly built to maintain accuracy under 24 hour production . . . completely enclosed for maximum safety . . . sealed ball bearings throughout . . . spindle speeds, 4000, 7000, 10,000 RPM . . . or with special motor, 2000, 3500, 5000 RPM (has been supplied on special order to 18,000 RPM) . . . allows extreme flexibility in sizes of work through use of space blocks under column to increase distance from table top to chuck . . . model M-100A allows 7" from face of column to center of chuck as opposed to 4½" horizontal distance in M-100 . . . both standard M-100 and M-100A available in single or multiple spindle design, two, three or four spindles as desired.

THE SIGOURNEY TOOL CO.
Hartford, Conn.

IMMEDIATE DELIVERY ! !

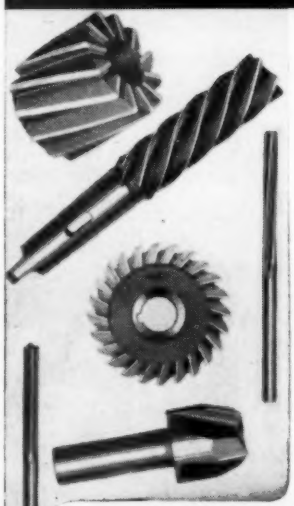
Illustrated bulletin on request.

Sole Sales Agents

PRATT & WHITNEY
Division Niles - Bement - Pond Co. West Hartford, Connecticut

More Cuts per Minute at Less Cost per Month

A.C.E. SPECIAL CUTTING TOOLS



A.C.E.'s long-wearing cutting tools are the result of careful study of customers' cutting needs and expert workmanship. Each tool is given complete and thorough inspection at all stages by an inspection department organized as a separate unit. This has resulted in a minimum of rejects.

Making *Special* Cutting Tools (we make none for stock) it has been difficult at times to keep up with the ever increasing demand for tools of our quality. However, modern methods and long experience have enabled us to handle the many set-ups required at almost mass production speed.

Send us your urgent inquiries on round work—we will send estimates promptly. Illustrated bulletin on request.

Certain territories open for representation by Active Agents.

AMERICAN CUTTER & ENG. CORP.
31745 Mound Road • Warren, Michigan

AMERICAN CUTTER AND ENGINEERING CORP., WARREN, MICH.

SPECIALIZING IN HIGH SPEED CUTTING TOOLS TO YOUR PRINTS

• To KNOW the fundamentals of TAP conservation is to make one tool do the work of TWO. There was a time when a single small tap didn't matter—much. Today, all cutting tools are important. Conserve them.

Used with studied care; the right tap with proper lubrication; WINTER TAPS will produce an unbelievable number of accurately threaded pieces.

Write for your copy of the data booklet illustrated above. It represents the condensed knowledge of taps and tapping gleaned from thousands of thread-cutting problems.

A Division of
The National Twist Drill & Tool Co.
Rochester, Michigan

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COMPANY
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It's SAFE and SMART to follow the LEADERS!

Production Experts Choose This Training Plan!

The Alexander Hamilton Institute's executive training program has been selected by thousands of big production executives. Their decision is well worth following.

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- Wm. A. Faison, President Atlantic Steel Casing Co.
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- J. W. Assel, Chief Engineer Timken Steel & Tube Co.
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There are no copies for the merely curious, but to all men of serious purpose, "Forging Ahead in Business" is sent FREE and without obligation. Fill in and mail the coupon below, and your copy will be mailed to you promptly. Do it today!

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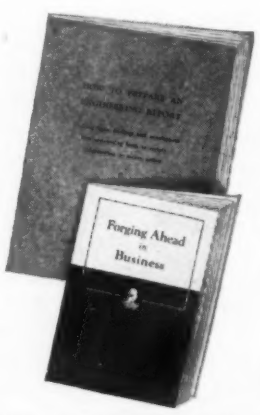

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Please mail me, without cost, a copy of the 64-page book —"FORGING AHEAD IN BUSINESS" and also a copy of "HOW TO PREPARE AN ENGINEERING REPORT," both without cost.

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Patent

UNIVERSAL BALL JOINTS

- Made in a range of 9 sizes for shaft diameters ¼" to 1⅜"
- Standard Joints have maximum angle of 38° from the straight line.
- Made by the largest manufacturers of UNIVERSAL JOINTS in Great Britain.
- Widely used in Machine Tools, accessory drives and on Aircraft.
- Certified 92% to 98% efficient by the British Government's National Physical Laboratory.

Catalogues on request.

The

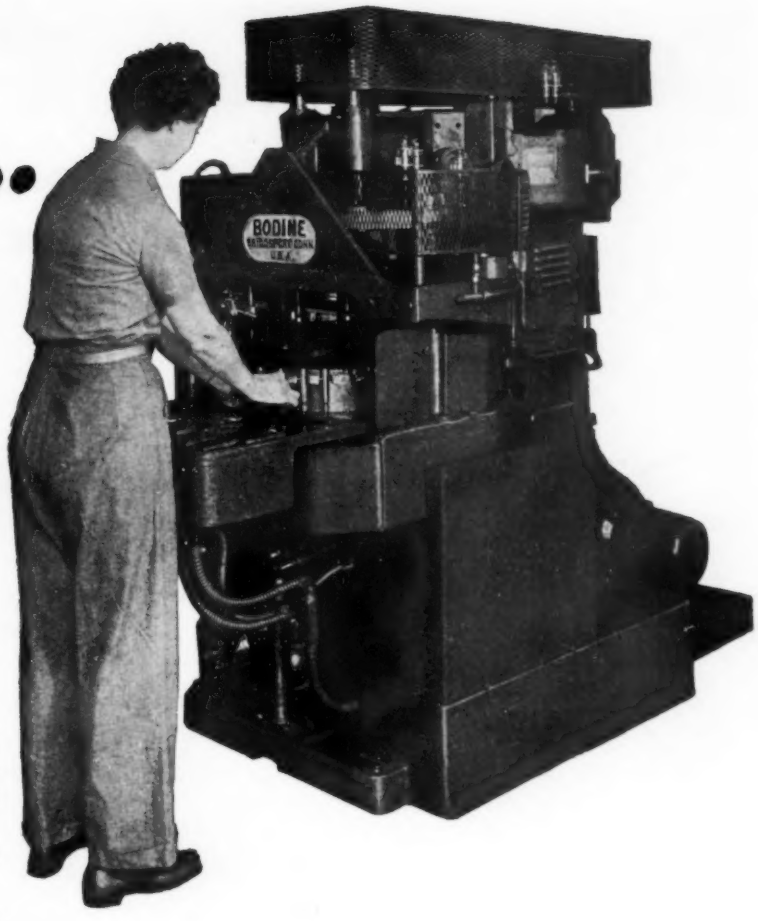
MOLLART

Engineering Co., Ltd.

KINGSTON BY-PASS, SURBITON, SURREY, ENGLAND.

Telegrams: PRECISION, SURBITON.

Now... SHE feeds a hungry *machine*



Sure... she could tote a tray with the best of them . . . and flash a smile and a quip that kept them coming. But punch the cash register? Never! What did *she* know about machinery?

Well . . . look at her now . . . helping to win a war.

Easily operated, automatic, high speed machines, like the Bodine, enable thousands like her to handle ordnance parts at high production schedules. The Bodine basic principle of design combines an automatic indexing dial with multiple spindles which operate on work placed in position on the dial. Spindles may be located at variable work stations to perform drilling, milling, tapping and screw inserting from *above, below* or from *any angle.*

The operator merely feeds and ejects the work—although under many conditions even the ejection is automatic. Moreover, several operations may be performed on each part as it progresses from station to station during one cycle of the dial.

Yes, women may be quickly trained to become efficient operators...and they like the low fatigue factor of running a Bodine.

DRILLING, MILLING, TAPPING, SCREW INSERTING *Simultaneously*

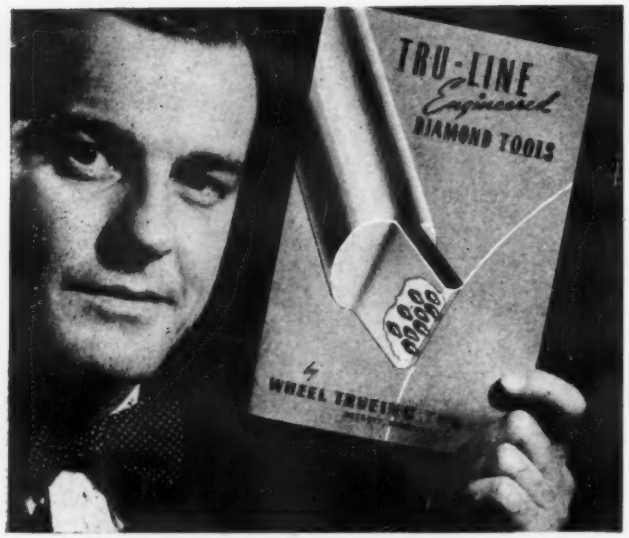
BODINE does this:

1. Builds 6 sizes of automatic dial type machines and develops correct tooling set-ups to perform the operations you require.
2. Provides extreme flexibility in the basic design to permit tooling for an exceptionally wide range of parts.
3. Provides up to 8 spindles with capacities ranging from ¼" to ½" dia. with vertical stroke from 13/16" to 3½" in depth.
4. Permits high speeds with extreme accuracy . . . minimizes down-time by means of automatic electrical devices which protect machines, tools and operator.

Ask Bodine engineers to make recommendations from your blue prints or sample parts to solve tough production problems. Interesting and instructive bulletin on request.

THE **Bodine** CORPORATION
BRIDGEPORT CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES



Here's Your Guide to Lower WHEEL DRESSING COSTS!

Of course you will want to know more about this new Tru-Line Principle of wheel dressing! The coupon below will bring you the facts about Tru-Line multiple-diamond Tools for straight, profile and step dressing operations—the tools that are amazing production men by their accuracy, their ability to speed production, and by the almost unbelievable savings in time and production costs they are accomplishing.

SEND FOR THIS NEW BOOK TODAY!

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Company _____

Address _____

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WHEEL TRUEING TOOL CO., INC.

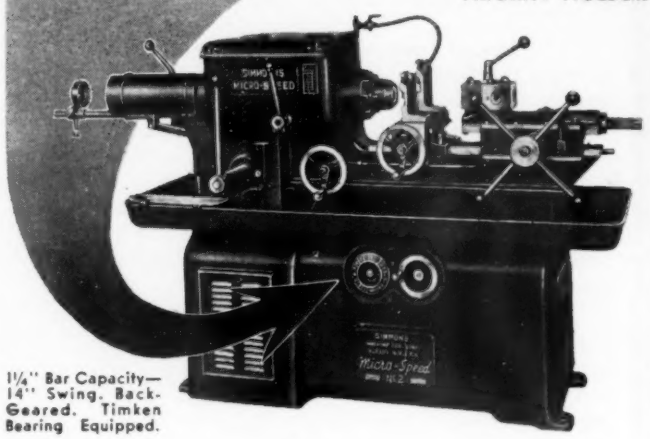
3200 W. DAVISON DETROIT, MICHIGAN

DIAMOND TOOLS FOR

STRAIGHT, FORM, THREAD AND RADIUS DRESSING;
TURNING • BORING • GAGES • CORE DRILLING

TURRET NO. 2 LATHES

QUICK DELIVERIES TO HIGH-RATING PRIORITY HOLDERS



1¼" Bar Capacity—14" Swing, Back-Geared. Timken Bearing Equipped.

YOU'LL find many hundreds of these sturdy Simmons No. 2 Turret Lathes producing high-precision work in important war manufacturing plants all over the country . . . plants like Bendix, Curtiss-Wright, Cessna, Fairchild, Bell, Sterling Engine, Greist, Swift Lubricator, to name a few.

Ease of operation, without sacrifice to precision or efficiency, has been an important factor in its wide acceptance. New operators, as a result, quickly learn to produce work of high quality. With the SIMMONS *Micro-Speed Drive*, built in the cabinet base, the operator can immediately select by a mere turn of a handwheel the best-suited spindle speed (up to 1500 RPM) for the work and cutting tools.

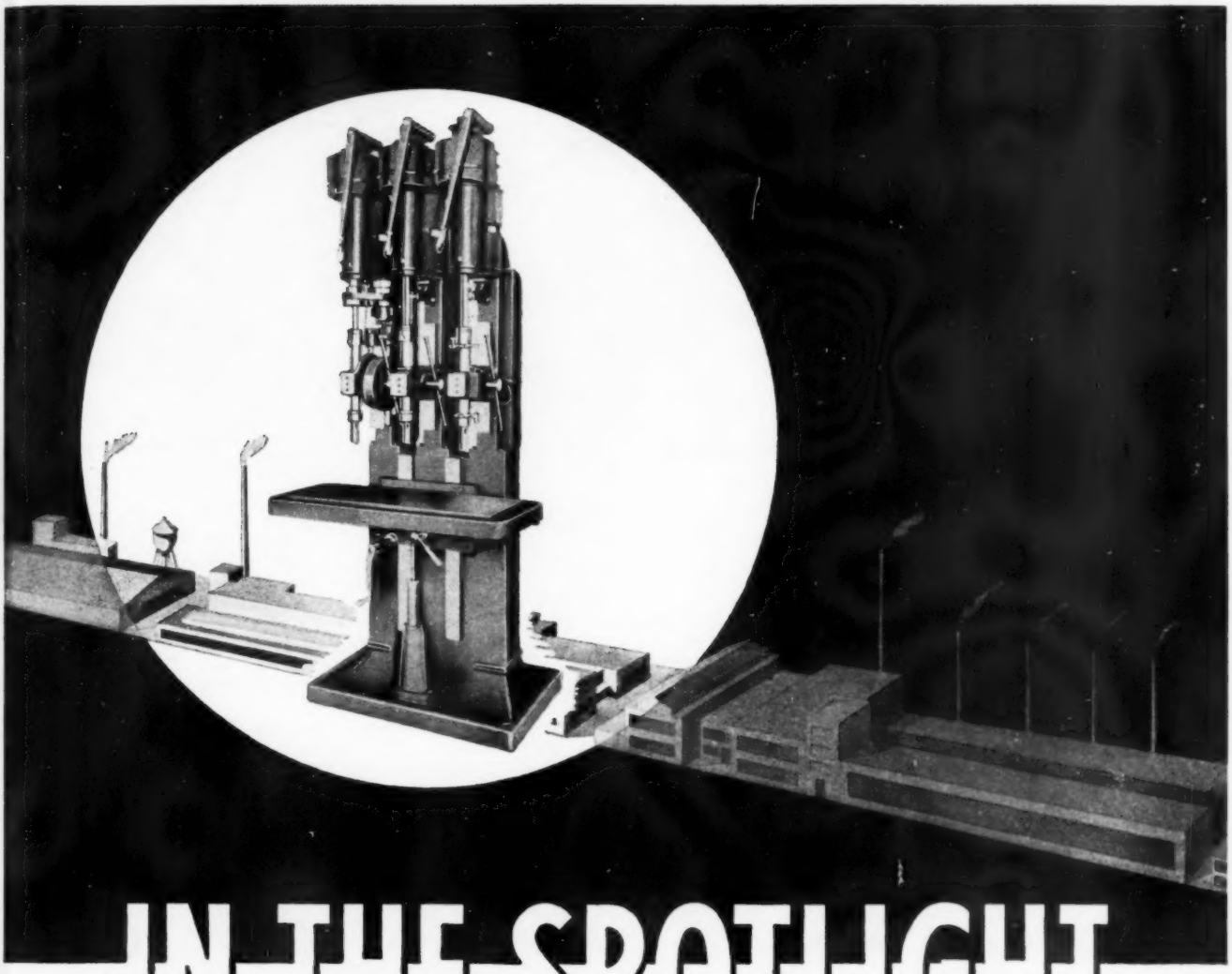
Ask for Details and Delivery Dates

SIMMONS MACHINE TOOL CORPORATION

Main Office: 1759 N. BROADWAY, ALBANY 1, N. Y.
New York Office: 149 BROADWAY

SIMMONS

LATHES · TURRET LATHES · MILLERS · PLANERS · & BAR BORING MACHINES



IN THE SPOTLIGHT

Occupying a prominent place on the production line of American Industries is the standard type AVEY Drilling Machine. Sturdily built to give longer operating hours, smoother performance and lower maintenance. A wise investment because it does your war job now—your peace job later, with no time out for conversion.

This AVEY Drilling Machine, Type MA-6, is now being built in No. 2 size (capacity in cast iron, 7/8"). No. 3 size (capacity in cast iron, 1 1/4"). One to six spindle units, either size. Six speed machine, two speed motor with three mechanical changes through gearing. Speed range is eight to one. Push button control. The above photograph shows the MA-6 equipped with three spindles, the Aveymatic Feed, Hand Feed and Tapper.

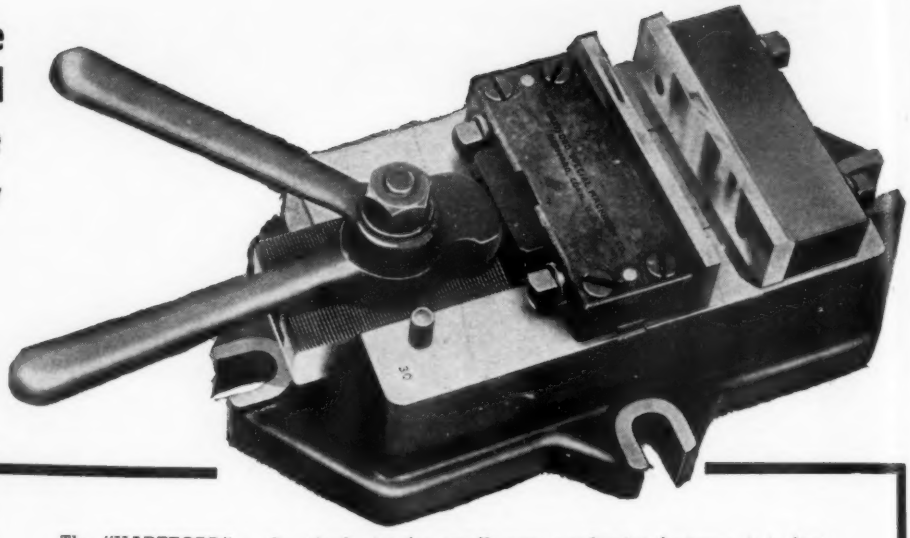
AVEY DRILLING MACHINE CO.
CINCINNATI, OHIO, U. S. A.

CINCINNATI · OHIO

Avey DRILLING MACHINES

All Operations Can Be Conveniently Performed with One Hand on the

"HARTFORD"
Quick-Acting
MILLING VISE



AVAILABLE IN PLAIN AND SWIVEL JAW TYPES

Jaw width — 5"
Jaw depth — 3/16"
Max. opening (Plain Jaw) —
  Jaws in place — 2⅝"
  Jaws removed — 3½"
Max. opening (Swivel Jaw)
  Jaws in place — 2¼"
Weight — 40#; Length — 13"
Width — 8"; Height 5"

Investigate!

THE HARTFORD SPECIAL MACHINERY COMPANY
HARTFORD, CONNECTICUT

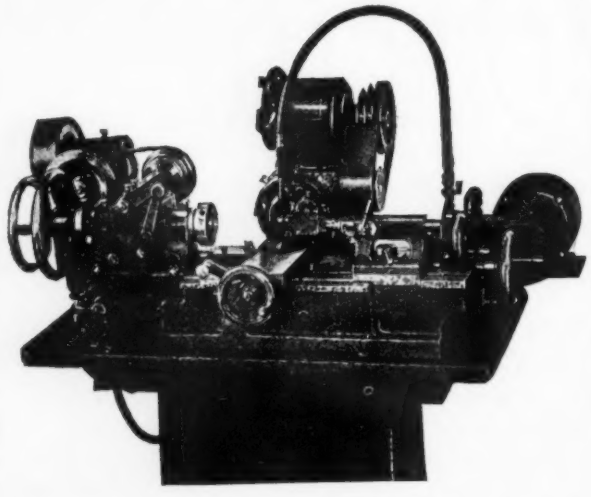
The "HARTFORD" is the ideal vise for small arms production because it is fast, powerful, accurate, easily handled and practically indestructible.

All operations are handled by manipulating two levers which, with a little practice, can be controlled by one hand. Quick opening and quick return are handled by the lower cam faced lever while the upper eccentric lever exerts the pressure for holding the work.

Holding action is such as to grip work securely under heaviest cuts and fastest speeds yet without danger of marring the piece between the jaws. Jaw can be moved about ⅞" for chip clearance or work removal by releasing binding lever and giving the cam lever a quarter turn.

Accuracy and strength are assured by a design where the movable jaw occupies the position occupied by the solid jaw in vises of conventional type. This feature of the "HARTFORD" also assures perfect jaw alignment regardless of where the jaws grip the work.

Precision production assures the use of interchangeable replacement parts. Screw holes in jaws conform to those of the No. 2 B & S Vise.



WALTHAM THREAD MILLER
WITH 3 MOTOR DRIVE

A semi-automatic machine for production or tool room service. It is best adapted for work 2" in diameter or smaller. Special equipment for short multiple cutter work with cam shaft control can be furnished. A cutter head for internal work can also be supplied.

WALTHAM MACHINE WORKS
HIGH STREET — WALTHAM, MASS.

ERRINGTON

Main Office and Works, Stapleton, Staten Island, N. Y.

TAPPING CHUCKS

NEW YORK
170 Broadway

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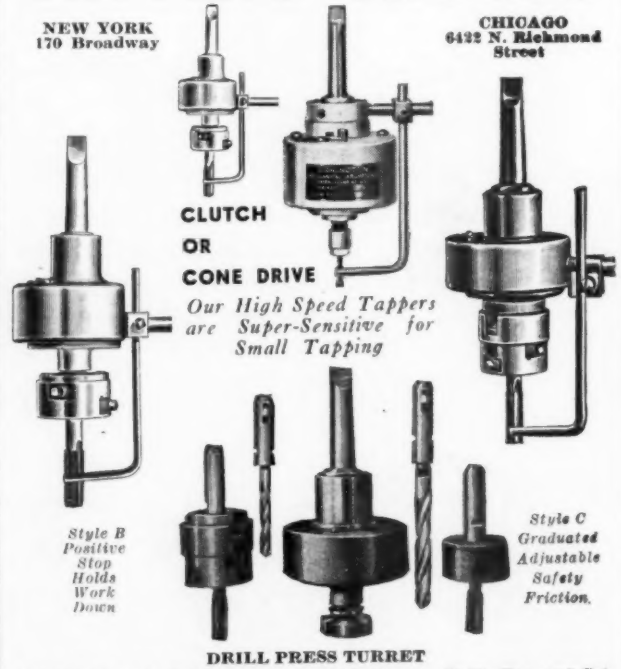


CLUTCH OR CONE DRIVE

Our High Speed Tappers are Super-Sensitive for Small Tapping

Style B Positive Stop Holds Work Down

Style C Graduated Adjustable Safety Friction

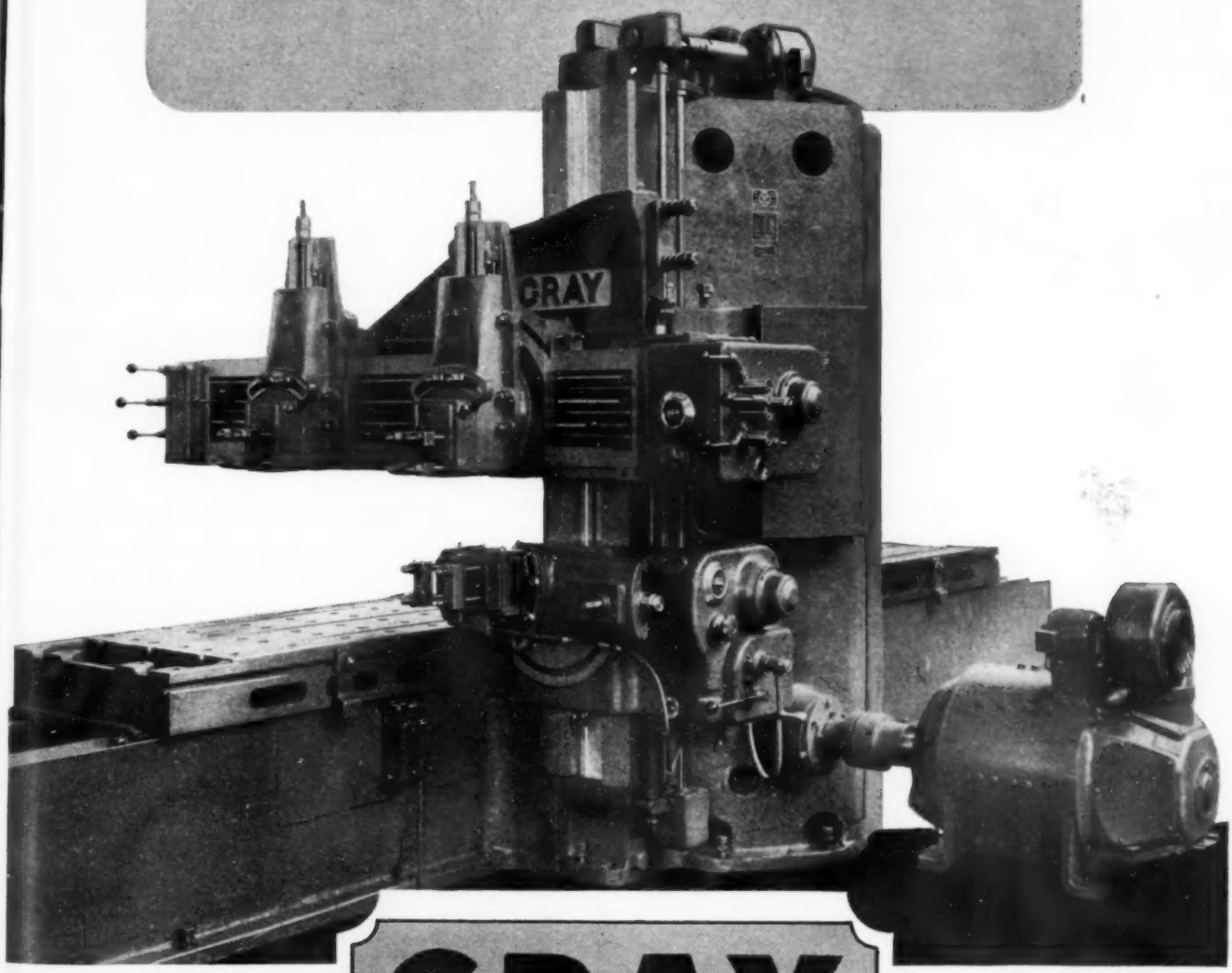
DRILL PRESS TURRET

Style D-E with Quick-Change Tool Holders to Drill, Tap and Set studs, etc., without moving work, or stopping or reversing machine. Individual friction adjustments in each tap-holder, if required.

Also, Opening Die-Heads; Opening Stud-Setters; Friction Screw-Drivers and Nut-Setters, etc.

SMALL but RUGGED

• Note that the column has the same cross section from the bottom to the top thus insuring maximum rigidity on high work. This valuable, distinctive feature is typical of the entire line of GRAY OPENSIDE PLANERS from this 36" to the 120". *Write for descriptive circular.*



THE G. A. GRAY COMPANY
Cincinnati Ohio, U. S. A.

THE GRAY LINE — Double Housing and Openside Planers, Switch Planers, Die Block Planers, Double-Housing and Openside Milling Planers, Planer Type Milling Machines, Horizontal Boring Machines.

Quality
THE NICHOLS MILLER
Offers SPEED with Tool Room ACCURACY
Modern precision construction and remarkable adaptability make the Nichols a natural choice for dependable performance.
Insets illustrate FLEXIBILITY. Upper view shows Profile-milling cam slot using template and follower. Lower view is typical horizontal setup, milling clutch teeth using simple indexing fixture.
Moderate price.
Ask for full details!
W. H. NICHOLS & SONS
Waltham Mass.
SOLE DISTRIBUTORS
NICHOLS-MORRIS CORPORATION
50 CHURCH STREET, NEW YORK, N. Y.
DEALERS IN ALL PRINCIPAL CITIES

Outstanding

PERFORMANCE
IN BUSY TOOL ROOMS

LINLEY

HIGH SPEED VERTICAL
MILLING and JIG BORING
MACHINES

Quick changeover from one type of set up to another . . . plus 8 spindle speeds . . . makes the Linley a tough little demon for die work, jib, metal pattern and model making and the diversified drilling, milling and reaming operations of a busy tool room.

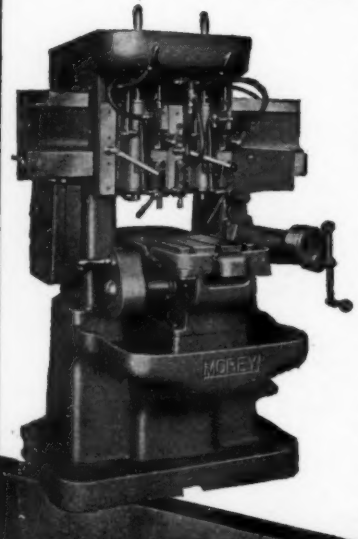
Accurate machining without chance of pencil-figure errors is assured by the simple direct micrometer setting. The Linley is a most profitable precision tool which frees larger machines for the heavier work.

Detailed Bulletin on Request

LINLEY BROTHERS COMPANY
664 STATE ST. EXTENSION
BRIDGEPORT, CONN.

MOREY
DESIGNED AND BUILT
For PRECISION Plus PRODUCTION

MOREY VERTICAL PROFILER
AND MILLING MACHINE



Over 2000 Morey Profilers in continuous service assuring speedy production for the United Nations in duplicating small parts.

Cross head is balanced on vibration-free cross rail . . . Clearance between spindle and table easily increased or decreased . . . Spindles mounted on precision bearings . . . Ball bearings throughout . . . Slides ride on scraped ways and are adjustable against future wear.

Ample provision for lubrication . . . Simple adjustment takes up backlash . . . No chatter marks on work . . . Table working surface, 12¾" x 15"

Write for Circular No. 680A

MOREY MACHINERY CO., INC
410 Broome Street New York, N. Y.

TO HIT 'EM H-A-R-D-E-R

THE year 1943 promises to be the grimmest, hardest year this country has ever faced. Every effort, and every dollar of national income not absolutely needed for existence, should go into war work and War Bonds.

In the Pay Roll Savings Plan, America finds a potent weapon for the winning of the war—and one of the soundest guarantees of the preservation of the American way of life!

Today about 30,000,000 wage earners, in 175,000 plants, are buying War Bonds at the rate of nearly half a billion dollars a month. *Great as this sum is, it is not enough!* For the more dollars made available now, the fewer the lives laid down on the bloody roads to Berlin and Tokio!

You've undoubtedly got a Pay Roll Savings Plan in your own plant. But how long is it since you last checked up on its progress? *If it now shows only about 10% of the gross payroll going into War Bonds, it needs jacking up!*

This is a *continuing* effort—and it needs *continual* attention and *continual* stimulation to get fullest results.

You can well afford to give this matter your close personal attention! The actual case histories of thousands of plants prove that the successful working out of a Pay Roll Savings Plan gives labor and management a common interest that almost inevitably results in better mutual understanding and better labor relations.

Minor misunderstandings and wage disputes become fewer. Production usually increases, and company spirit soars. And it goes without saying that workers with substantial savings are usually far more satisfied and more dependable.

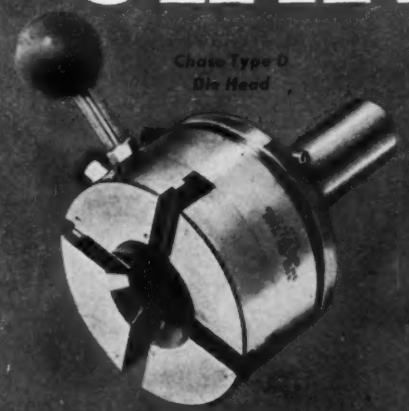
And one thing more, these War Bonds are not only going to help win the war, they are also going to do much to close the dangerous inflationary gap, and help prevent post-war depression. The time and effort *you* now put in in selling War Bonds and teaching your workers to save, rather than to spend, will be richly repaid many times over—now and when the war is won.

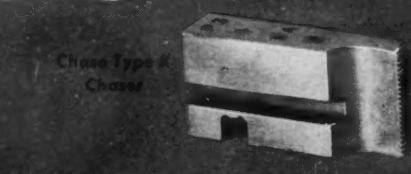
★ ★ ★

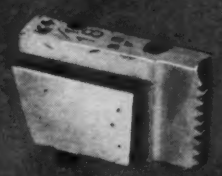
You've done your bit Now do your best!

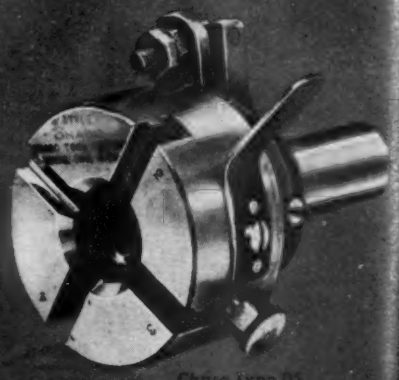
This space is a contribution to victory today and sound business tomorrow by AMERICAN MACHINIST

CHASO Threading Tools









IT'S Chaso FOR CHASERS!

We make chasers for most of the well-known makes of self-opening die-heads.

● CHASO CHASERS must prove satisfactory in order to fulfill the CHASO guarantee for quality, workmanship and accuracy. It means also that users of CHASO THREADING TOOLS must obtain better service in terms of more threads of closer accuracy between grinds.

● CHASO production methods assure the satisfactory performance of CHASO CHASERS AND DIE HEADS. Write for our catalog.

CHASO TOOL COMPANY, Inc. Royal Oak, Michigan

MOREY Designed and Built FOR Precision PLUS Production

VERTICAL SHAPERS 8"–12"–14" STROKES

Four cutting Speeds . . . infinite feed variations quickly selected . . . Directional control for all movements . . . Rapid power movements in all directions . . . Brake for Ram automatically applied...OPERATOR CONTROLS MACHINE WITHOUT MOVING FROM HIS WORKING POSITION . . . Timken Bearings for Bull Gear, Shaft and Rotary Table . . .

ACCURATE, POWERFUL, FAST, FINGERTIP CONTROL

Ask for Circular No. 726A

MOREY MACHINERY CO., INC
410 Broome Street New York, N. Y.

For cutting internal keyways, slots or splines 1/16" to 4" wide and up to 60" long. Fast—Accurate—Flexible. Write for particulars and catalog on machine for your work.

Giant KEYSEATERS

MITTS & MERRILL
913 Tilden St.
Saginaw, Michigan

DIE HEADS Self-Opening TAPS Collapsible

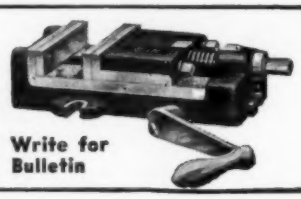
THREADING MACHINES

MURCHEY MACHINE & TOOL CO.
951 Porter St. Detroit, Mich.

ACROMARK

numbering, stamping and marking machines and accessories are extensively used where fast, accurate permanent work is a prerequisite.

THE ACROMARK CO. ELIZABETH NEW JERSEY



Write for Bulletin

STEVENS MILLING MACHINE VISES

5 in., 6 in. and 7 in. sizes
All parts Interchangeable

JOHN B. STEVENS INC.
474 Canal St., New York, N. Y.

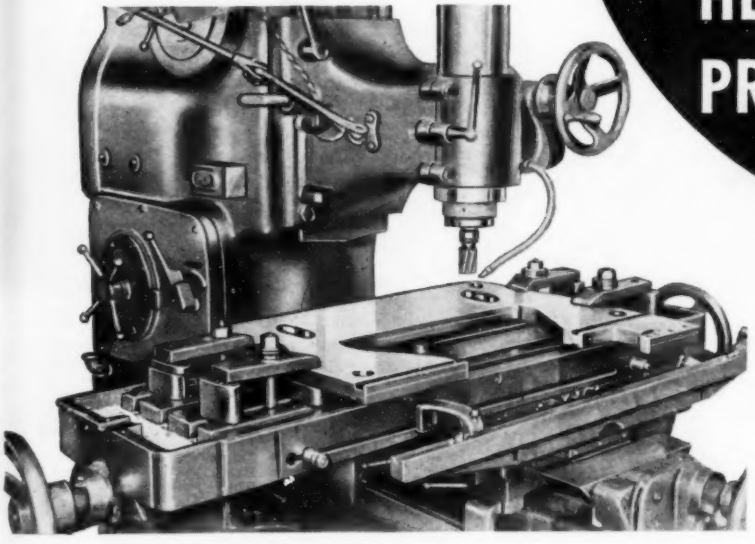
BALANCED QUALITIES OF THE KNIGHT-Miller ADAPT IT TO EACH JOB...

whether

LIGHT MILLING
HEAVY MILLING
PRECISION BORING

KNIGHT VERSATILE MILLERS ACCURATE · RIGID

On the large one-inch steel plate in picture, many operations were performed at one setting, including profiling, milling, boring, slotting, and key-way cutting.



KNIGHT Millers' wide range of spindle speeds, solid table unit, and ease of handling make possible efficient production and accurate results on such operations as described above. Where speed and convenience are required, KNIGHT Millers deliver—where power and rigidity are required, KNIGHT Millers are fully able.

Dial indicators for quick and accurate locating—a large accurately fitted spindle to insure round and straight holes and table slides that are square made the KNIGHT Miller particularly adaptable for handling a boring job on an eighteen-inch by twenty-nine-inch plate, two inches thick. Nine holes, ranging from one and one-eighth inches to two inches in diameter were accurately bored to limits of plus or minus .0001".

★ Because all of the qualities that make balanced design have been included in KNIGHT Millers, users get the maximum of service without the sacrifice of one quality for another.

KNIGHT Miller BALANCE includes CAPACITY which enables users to turn out quality work at greater speed.

Plus this there is ACCESSIBILITY which makes possible more efficient operation—faster manipulation, and quicker set-ups.

To also aid in increasing production volume and insuring high standards of workmanship, RIGIDITY has been built into the design.

KNIGHT VERSATILITY gives these Millers capabilities which greatly simplify many set-ups that would otherwise be difficult to obtain.

Added to all this is ACCURACY that helps you turn out quality jobs.

KNIGHT Millers subject to prior order for immediate delivery. Write for catalog.

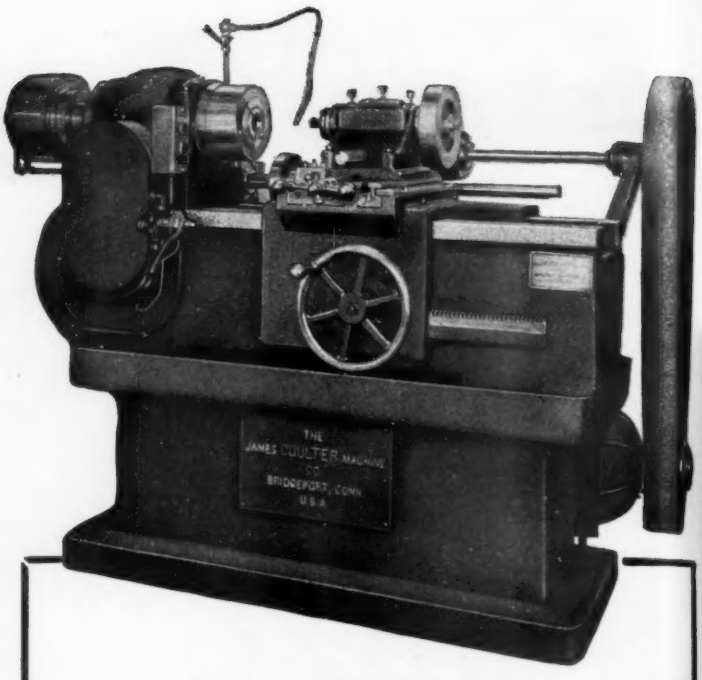
W. B. KNIGHT MACHINERY CO.
• ST. LOUIS, MISSOURI •

Keep Ahead of
DEFENSE DEMANDS
on the PRODUCTION of
EXTERNAL and INTERNAL THREADS

The Coulter Type "H" Hob Thread Miller—modern in every detail of design and construction—handles high speed, accurate production of right or left hand threads. Any parts that can be held in ordinary chucks, air operated chucks, air operated collet chuck or special face plate fixture can be threaded on this machine.

Work holding spindle and cutter spindle are driven by individual motors through worm and gears. Speed changes to work spindle are accomplished by pick-off gears; cutter spindle speeds are controlled by variable motor sheave. All high speed shafts turn in anti-friction bearings.

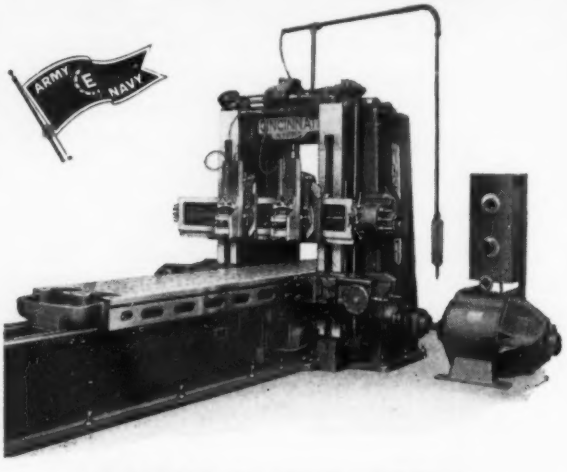
Maximum external thread, 7"; minimum hole depends on smallest hob practical.



Send for Descriptive Bulletin giving full information.

The James COULTER *Machine Co.*
BRIDGEPORT • CONNECTICUT • U.S.A.

HYPRO-DUCTION PLANERS



REDUCE PLANER COSTS

• Manufactured to increase profit. Rigidity insures accuracy. There are numerous unexcelled HYPRO-duction features embodied in Cincinnati Planer design. Full line in double housing and openside types, 36" to 120".

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THE CINCINNATI PLANER CO.
Cincinnati, 9, Ohio

NATIONAL KEYSEATING MILLER

. . . the tool that converts drilling machines into key-seaters and saves time and money

• With this modern tool you can handle keyseating jobs not suitable for keyseating machines on any of your drill presses or radials. Keyseats with parallel sides, accurate in depth and in perfect alignment with bore axis are assured.

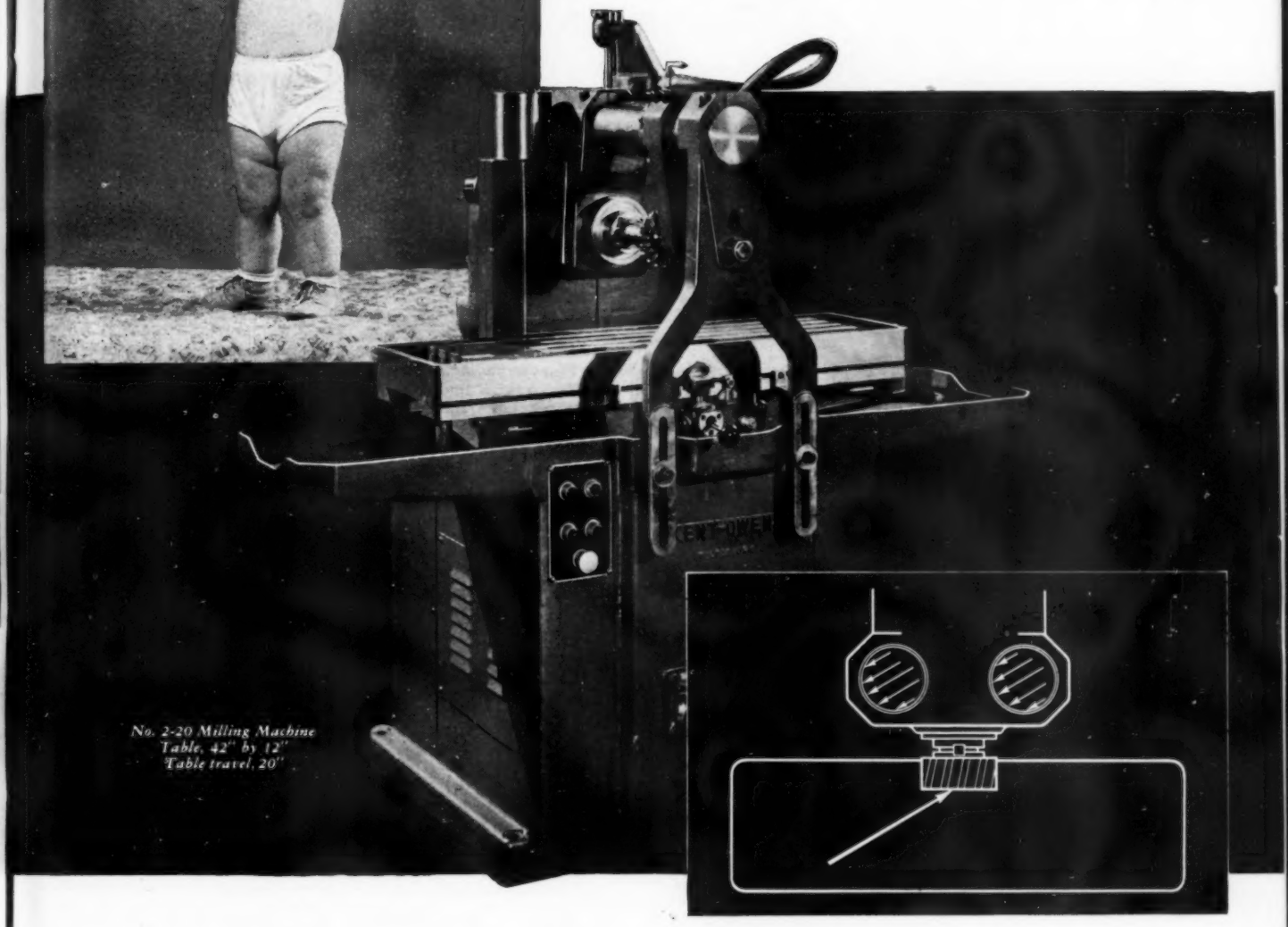
The National Keyseating Miller mills, keyseats in one cut. It can be used on taper holes, offset holes, blind holes and for taper keys. Work clamping is unnecessary. We also manufacture oil-grooving millers.

Made in twenty-six different diameters from ½" to 3½". Several widths of cutters can be used in each size.

WRITE TODAY FOR OUR NEW CATALOG NO. 15

NATIONAL MACHINE TOOL CO.
CINCINNATI, OHIO

Balanced load!



No. 2-20 Milling Machine
Table, 42" by 12"
Table travel, 20"

Exclusive TWIN POST MOUNTING
offers BALANCED LOAD IN EITHER DIRECTION

★ In Kent-Owens Milling Machines . . . the head is mounted on two cylindrical ground steel posts which carry the spindle midway between them. There is no overhang and no cocking action. The result is an unusually rigid and accurate machine which is practically chatter-proof for either direction of table travel. Write for latest bulletins. Kent-Owens Machine Company, Toledo, Ohio.

THERE'S A KENT-OWENS REPRESENTATIVE NEAR YOU

BOSTON
General Machinery Corp.

BUFFALO
Don W. Patterson

CHICAGO
Neff, Kohlbusch & Bissell

DALLAS
Hamilton-Huster Machinery Co.

DAYTON
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DETROIT
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GRAND RAPIDS
Joseph Monahan

HOUSTON
Oliver H. Van Horn Co., Inc.

INDIANAPOLIS
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KANSAS CITY
Eichman Machinery Co.

LOS ANGELES
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John J. Normoyle Co.

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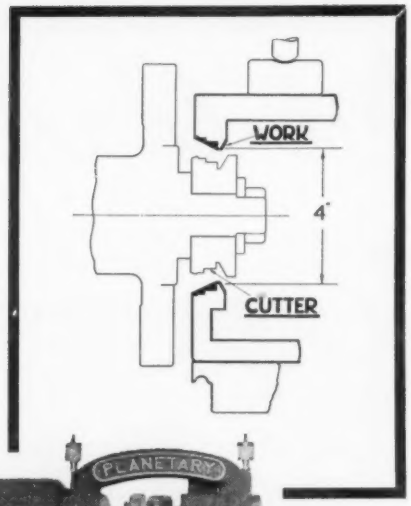
WALKERVILLE
F. F. Barber Machinery Co.

Call on KENT-OWENS *for Milling Machines*

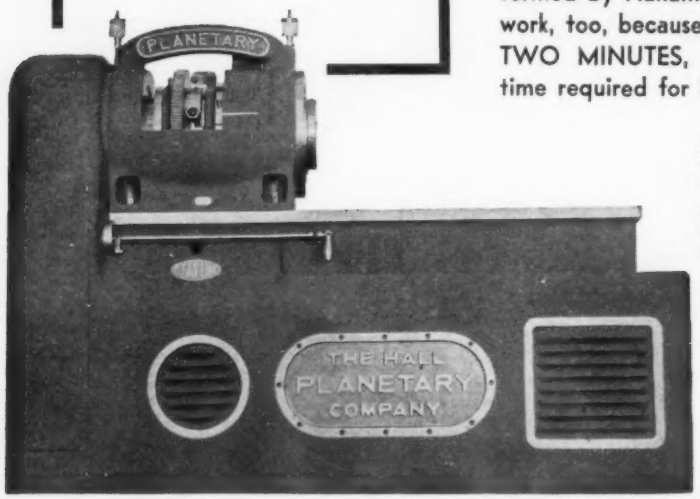


PLANAMILLING

2 MINUTES FLOOR TO FLOOR TIME

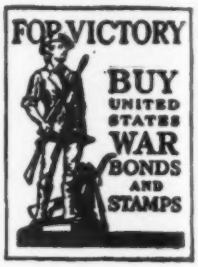
Note this job which involves machining a number of sizes which must be held to uniform dimensions calling for close tolerances.

This operation is easily and accurately performed by Planamilling on the Planetary. Fast work, too, because the production time is only TWO MINUTES, floor-to-floor, and includes time required for loading.



Perhaps your job can be better handled by Planamilling or Planathreading. If so, it will pay you to find out. Our engineers are ready to help you. Just submit your problem.

THE HALL PLANETARY CO.
Fox & Abbotsford Ave.,
PHILADELPHIA, PA.



BURKE MILLING MACHINES

. . . Put Your Small Work on a Production Basis!

Those small, difficult jobs can be handled on a *production basis* with BURKE Motor Driven Milling Machines Nos. 1, 2, 3, & 4. Primarily, this is because BURKES have been *specially designed and built* to do smaller milling jobs efficiently and economically.

Then, too, a number of attachments are available . . . attachments that increase the units usability, and add to your productivity. These include a vertical milling attachment, index centers, and vises—3 types, including swivel base. Now, when production must be stepped up, is the time to investigate the profit possibilities of BURKE Milling Machines, as applied to your work.

Complete Information Will Be Sent You Upon Request—Write!

BURKE MACHINE TOOL CO.
CONNEAUT · · · OHIO

DAVIS KEYSEATER

This low cost machine will handle any keyseating job in the shop up to 1¼ in.

Write for illustrated bulletin

DAVIS KEYSEATER CO., 403 Exchange St., Rochester, N. Y.

SMITH & MILLS
CRANK SHAPERS

sizes 12" to 32" stroke

THE SMITH & MILLS CO. Cincinnati, Ohio

RANDALL & STICKNEY
Universal Gauge

for rigid inspection of a wide range of parts . .

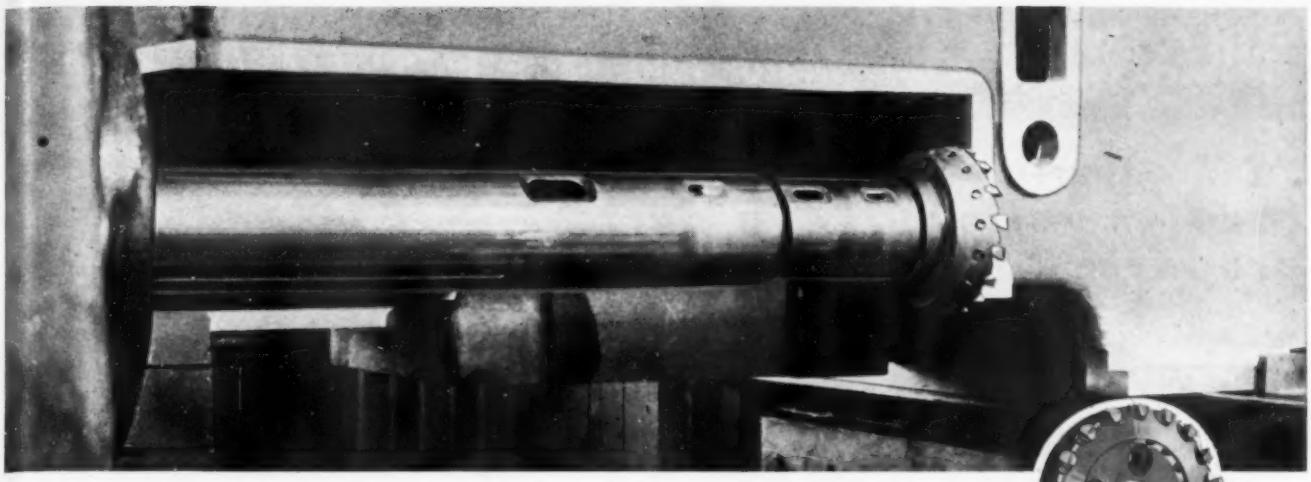
An almost unlimited use is offered by this instrument for inspecting duplicate parts in quantity or any small parts with flat surfaces or recesses.

Use of standard blocks made possible by raising or lowering table increases capacity to take material up to 2" in height. Graduated to read to .001 inch; height 9¾"; weight 5 lbs., 1¼ oz.; depth from frame to spindle 1⅝".

Can be supplied with sliding head and table; also on a stand with throat 3" deep.

Full details on request

RANDALL & STICKNEY
Makers *Waltham, Mass.*



LOVEJOY CUTTERS *refuse to "Walk"*

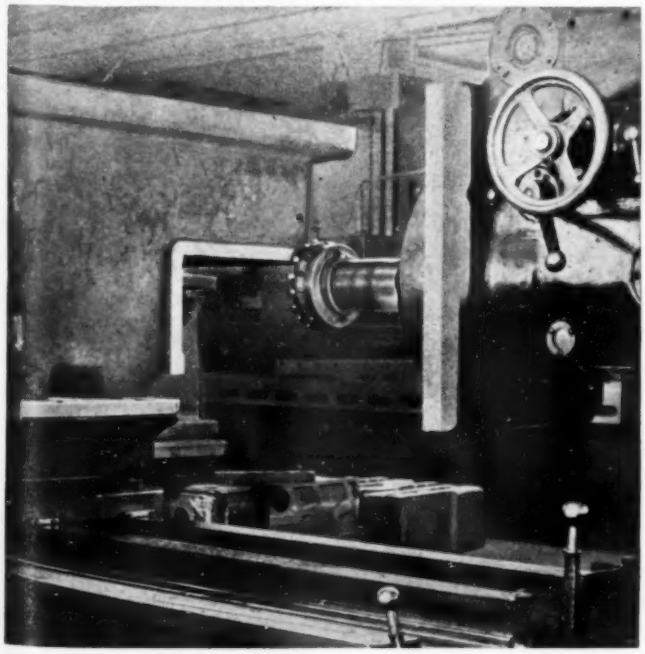
ON JOBS REQUIRING EXTREME OVERHANG OF THE MILLING SPINDLE

Overhang on milling spindles is often like a "hang-over" for all the headaches involved. The problem presented by the job shown here, however, was completely solved by using a *free cutting* Lovejoy Milling Cutter. It takes a combination of the best machine and tool to prevent "walking" on jobs like this.

Universal Boring Machine Company uses these cutters exclusively for precision milling their boring machine bed castings, as well as for dozens of other milling jobs throughout the plant.

As an added feature, Lovejoy cutters, with *positive-locking* blades, reduce power costs, down time and sharpening costs. For complete details on these superior tools, mail the coupon today.

PHOTOS COURTESY UNIVERSAL BORING MACHINE CO.



LOVEJOY TOOL CO., Inc.

Springfield, Vermont, U.S.A.

Please send me the Lovejoy General Catalog.

NAME_____ TITLE_____

COMPANY_____

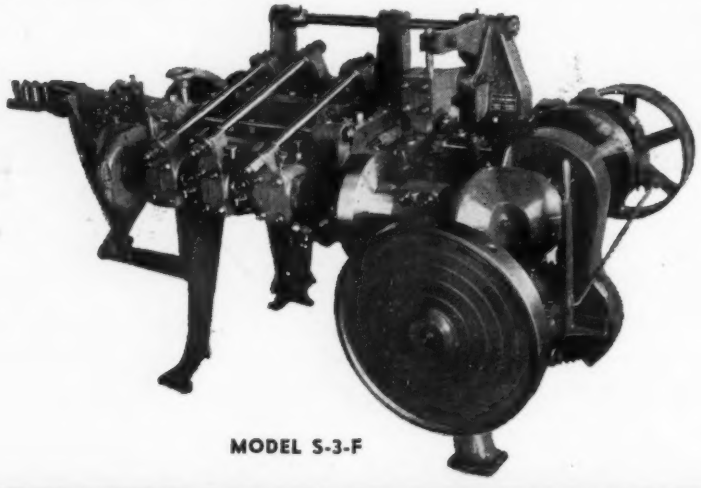
STREET_____

CITY_____ STATE_____

AM

NILSON *Automatic Metal and Wire Forming* MACHINES

. . . assuring faster work and greater uniformity in parts produced . . . . . .



MODEL S-3-F

The new Nilson Ribbon Stock Forming Machines are a development—the result of more than fifty years specialization in the design and building of metal forming machines. They can be depended on for speed, durability and accuracy and are built in 4 sizes for handling from 3/32" to 1¼" in diameter and stock from 1¼" to 2½" wide.

Outstanding features include:

. . . open construction of the press and forming tools
. . . patented slide feed has independent cam-operated wire gripping device
. . . power operating wire feed is transmitted through a straight line.

ILLUSTRATED BULLETIN GIVING DETAILED SPECIFICATIONS . . . .

available on request

Nilson is prepared to design and produce special automatic machinery of high productive capacity. Our long experience in this class of work enables us to offer an expert and comprehensive service on special machines. Outline your problem—ask for our recommendations.

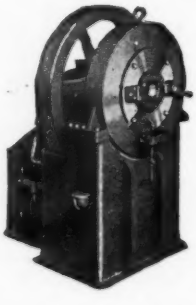
THE A. H. NILSON MACHINE CO. . . . *Bridgeport, Conn., U.S.A.*

Cartridge Case Dies

. . . WITH TALIDE NIBS made of Solid Tungsten Carbide, are producing millions of primer cups, small arms ammunition cases and jackets, and cartridge cases in sizes 20 m/m to 105 m/m with Better Finish, Longer Life, Closer Tolerance and Fewer Rejects . . . including cupping, drawing, tapering, sizing and pointing operations.

TALIDE

METAL CARBIDES CORPORATION
YOUNGSTOWN, OHIO
TUNGSTEN CARBIDE TOOLS · DIES · WEAR PARTS



THE
TORRINGTON
ROTARY
SWAGING MACHINE

— with 4000 forceful squeezing hammer blows per minute—makes metal tougher and more elastic. Send for booklet—"The Torrington Swaging Machine."

The Torrington Co., Swager Dept.
56 Field Street Torrington, Conn.

BAUMBACH
STANDARDIZED
DIE SETS

BETTER-MADE
DIE SETS
AT LOWER COST

46 Styles—195,000 Sizes

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Machined Steel Semi-Steel
Send for our new catalog
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DIES ***TAPS***

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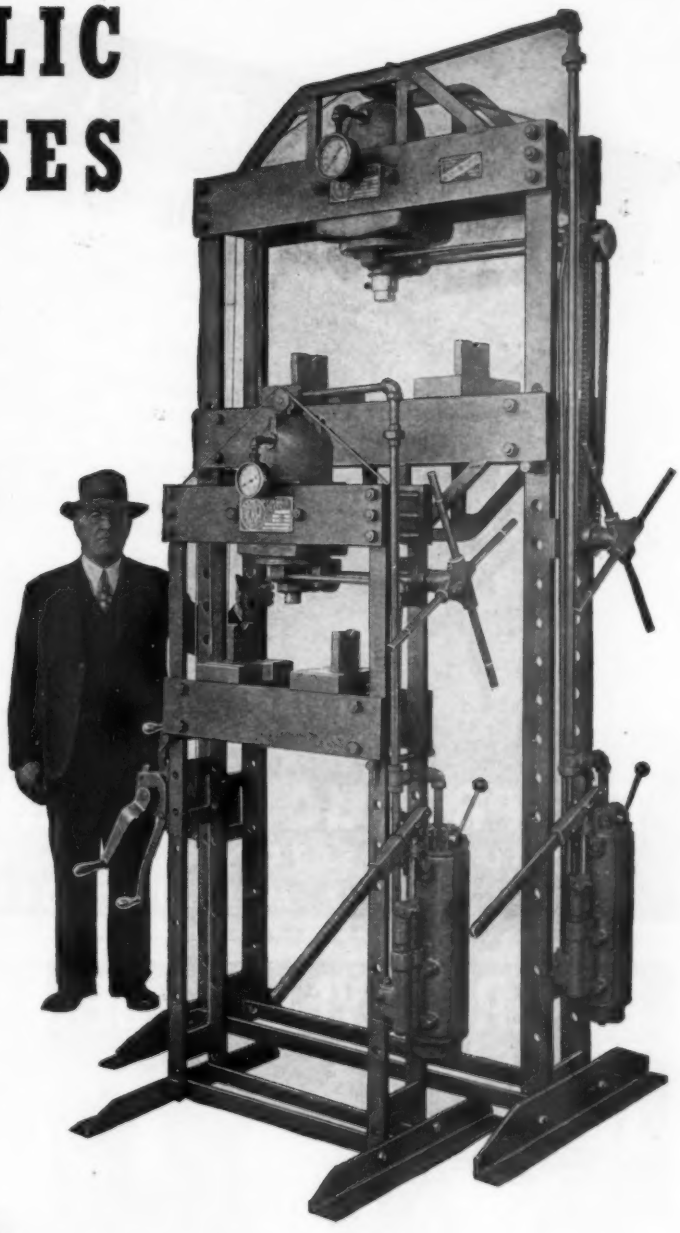
Right from the Lead

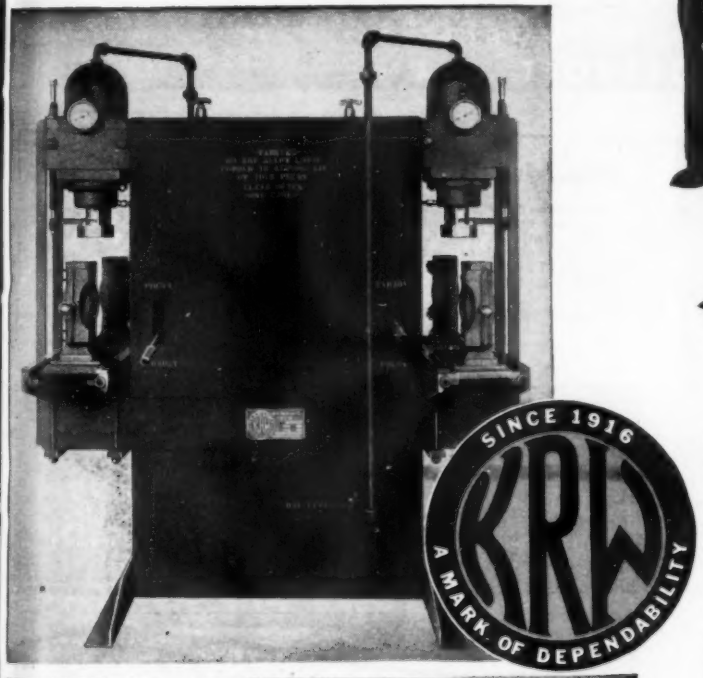
THE GEOMETRIC TOOL CO.
NEW HAVEN, CONN.

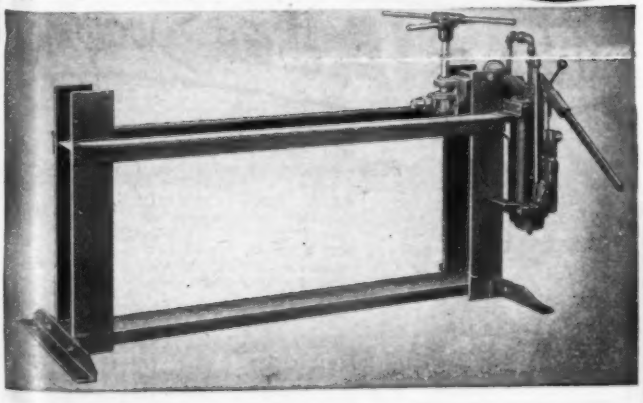
KRW HYDRAULIC ARBOR PRESSES

for War Production

Standard Hydraulic Presses in 25, 50 and 75 ton capacities. Special Presses engineered for specific war production needs.







The exclusive design features which have given KRW Standard Presses their reputation for speed and efficiency are available to war production manufacturers who require presses of special design. The illustration above shows a *special*, extra high 75 ton KRW Press in comparison with the Standard 25 ton unit. Opposite illustration shows a special, 4-man operated, air-oil Press used for bomb loading. Press illustrated at lower left is a special horizontal design built to meet customer's requirements.

KRW also builds bench-type Arbor Presses in ½, 1 and 3 ton capacities.

K. R. WILSON
10 LOCK ST., BUFFALO, N. Y.

FOR SERVICE

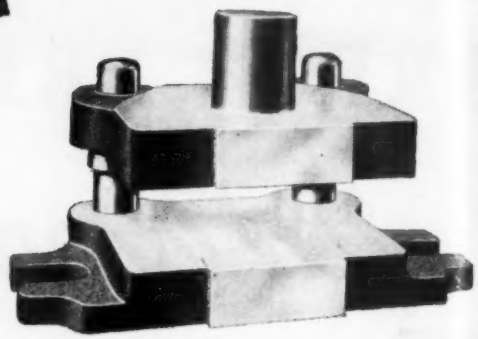
PRODUCTO DIE SETS

To speed up stampings for War Production. Producto Die Sets are available for quick assembly and shipment.

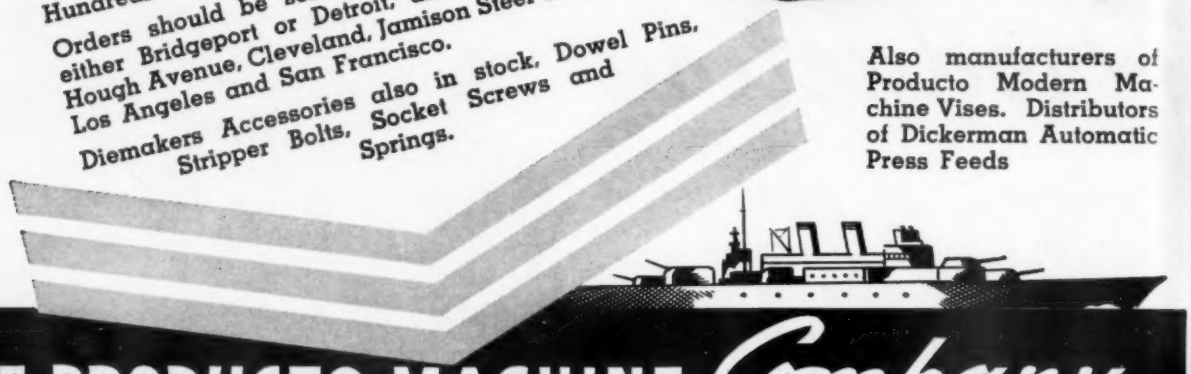
Hundreds of sizes for all types of Dies.

Orders should be sent to nearest assembly plant either Bridgeport or Detroit, also Die Supply 4747 Hough Avenue, Cleveland, Jamison Steel Corporation, Los Angeles and San Francisco.

Diemakers Accessories also in stock. Dowel Pins, Stripper Bolts, Socket Screws and Springs.



Also manufacturers of Producto Modern Machine Vises. Distributors of Dickerman Automatic Press Feeds



THE PRODUCTO MACHINE Company

940 HOUSATONIC AVE. BRIDGEPORT, CONN.

3017 MEDBURY, DETROIT, MICH.

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Made in 5 SIZES!

ADAPTABLE to a wide range of light or heavy work—for maintenance or production. Operated either mechanically or electrically, these hammers are not steam or air hammers . . . adjustable for different thicknesses of dies and material . . . extremely powerful . . . flexible in operation with perfect control and little effort . . . ram free from obstruction assuring full vision of work. Complete information upon request. Ask about repair parts service.

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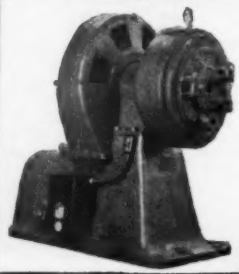

● If you have a production phase that calls for tapering, sizing or reducing of solids or tubes, you can save money if you "ASK ETNA ABOUT SWAGING." The superior performance of ETNA machines assures you more pieces per hour at lower cost. Built in capacities of 1/8" to 4" . . . larger sizes built to order!

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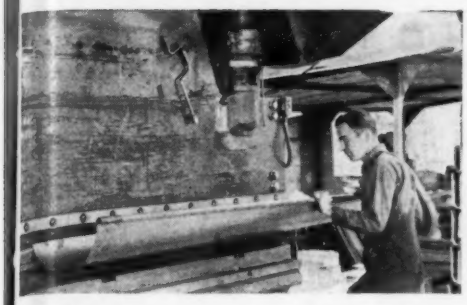
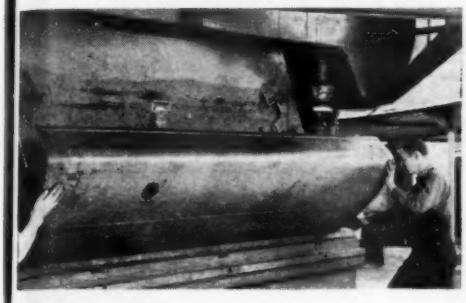
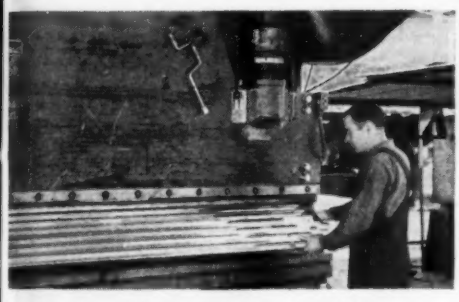


Beading operations on a cement chute.

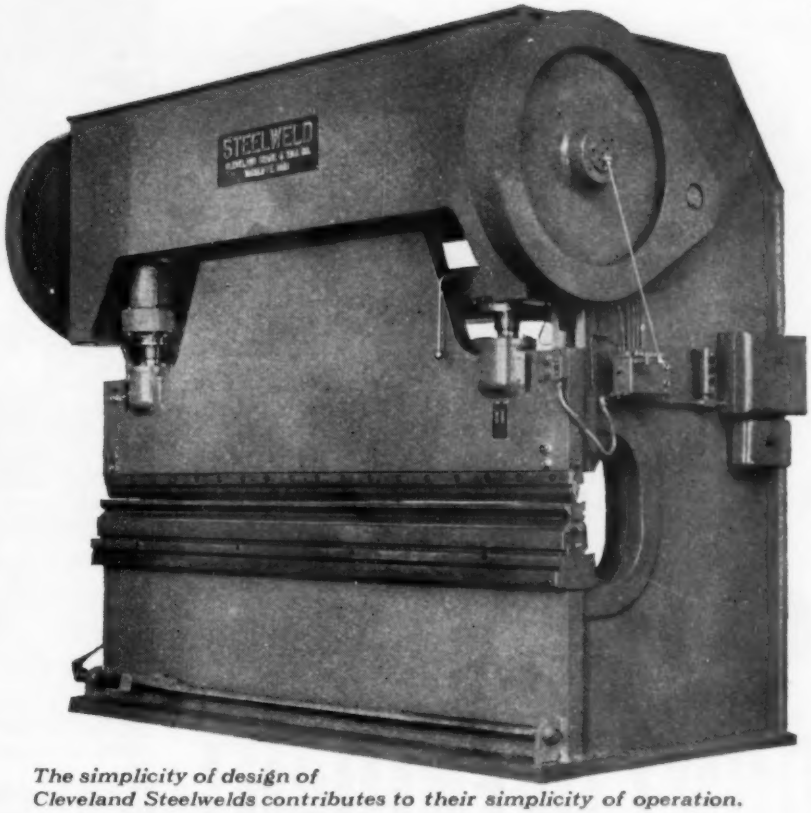


Forming a motor housing top.



Corrugating metal for bomb door.

Producing a 6-inch diameter cylinder.



The simplicity of design of Cleveland Steelwelds contributes to their simplicity of operation.

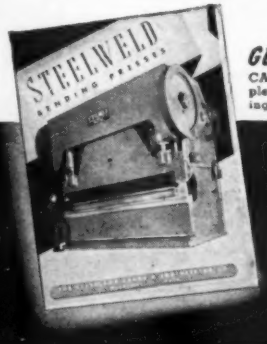
RUGGED FOR HEAVY PLATES AND ACCURATE FOR LIGHTER MATERIALS

Nothing need be added to the following paragraphs from a letter of the Fleming Sheet Metal Works, Los Angeles, Cal.

"Since we are a jobbing shop the material formed varies from 18 gauge up to ½-inch plate 7 feet long. From the time the presses were purchased we have formed 5000 ¼-inch plate enclosed channels 4 x 8 x 60 inches long; 2 or 3 thousand ¼-inch plate hatch coamings; hundreds of light gauge body parts, and thousands of bomb door corrugations.

"We have found the presses to be rugged for heavy plates and still hold accuracy for lighter materials. We run our presses from 8 to 16 hours per day 6 days per week. The Steelweld presses are entirely satisfactory and the simplicity of design contributes to the simplicity of operation."

The illustrations show few of the many varied jobs to which Fleming has adapted its Cleveland Steelwelds that were installed two years ago.



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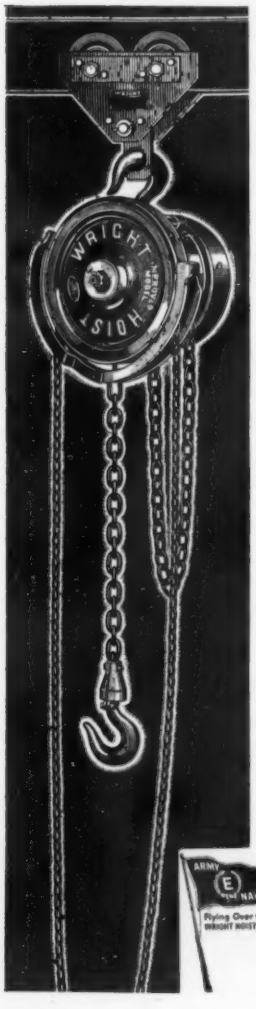
DON'T OVERLOAD!



WRIGHT HOISTS are built to carry more than their rated capacities, but like other well-made pieces of mechanical equipment they should not be overloaded. Overloading is dangerous—while today, abuse to machinery is akin to sabotage.

Watch the bottom hook

WRIGHT load hooks are drop-forged from special steel which, when subjected to excessive overloading, give visible warning by opening slowly. When the bottom hook has started to open, look to the top hook, too, for while it is stronger than the bottom hook, it also may be reaching a danger point.

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WRIGHT HOIST load chains are electrically welded from special analysis steel, exceptionally high in tensile strength and elastic limit. Excessive overloading will stretch the chains out of pitch, thus preventing proper fit with load wheel pockets. This results in destructive wear to both chain and load wheel. Keep your chains well lubricated for long life. Take proper care of your **WRIGHT HOISTS.** You'll find the name of your nearest **WRIGHT** distributor in the telephone book.

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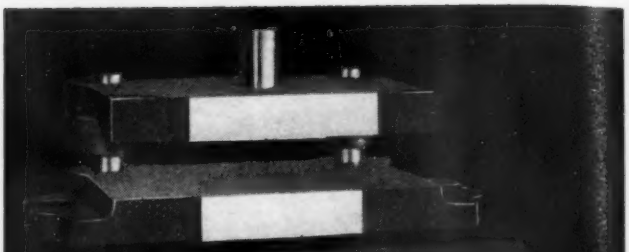

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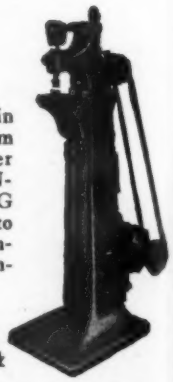

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Booklet

For Your

DIE DEPARTMENT

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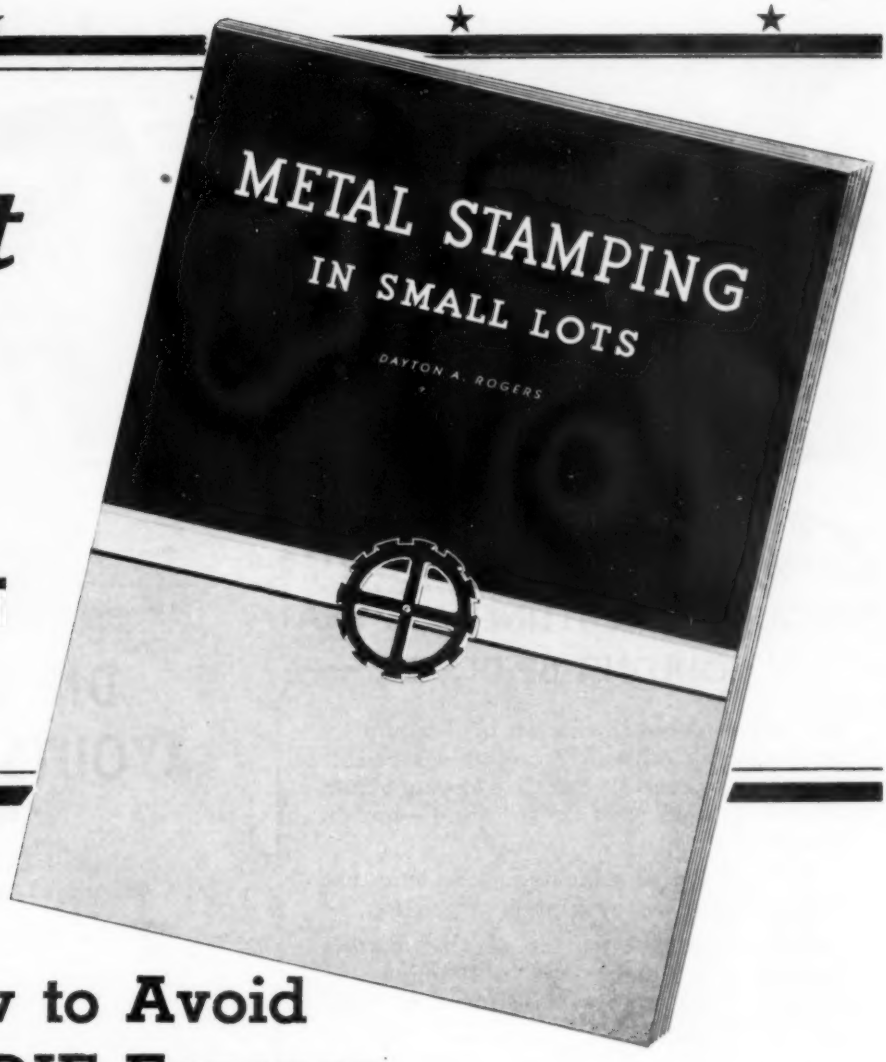

Shows how to Avoid Excessive DIE Expense On Small Lots of Metal Stampings

IN RESPONSE to insistent demand, this new booklet "Metal Stamping in Small Lots" has been prepared by The Dayton Rogers organization, which for twenty years has developed and perfected a "small lot" metal stamping technique.

THE BOOKLET shows how metal stamping in quantities from 25, 50 or 100 up to 8,000 or 10,000 can be produced just as accurately as with permanent dies, yet for only 15 or 20 per cent of the cost of such dies. The Dayton Rogers specially constructed temporary dies assure you of exact duplication of all blanks, pierced holes, slots and forms to your specifications, in the metal stampings delivered to you.

THIS SERVICE IS IDEAL for products requiring only limited output, for improvements in present models or perfecting new models. In many cases it eliminates the need for expensive permanent dies, or avoids costly, time-consuming die alterations. The booklet presents valuable information for Tool and Die Depts., Designing Engineers and Production Executives. A request on your letterhead will bring promptly a copy of "Metal Stamping in Small Lots."

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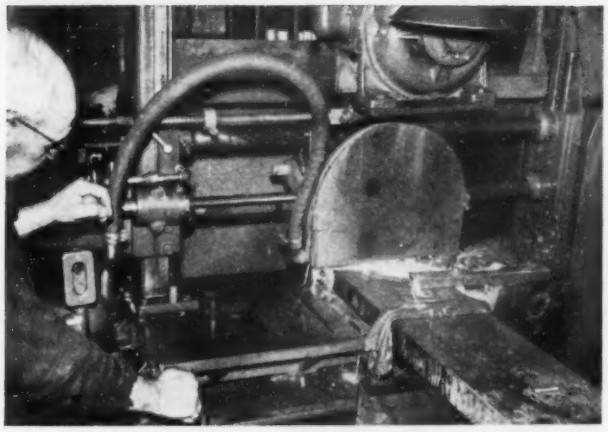

No. 302 Campbell Abrasive Cutting Machine cutting 18/8 Stainless Steel forging blanks from slab 2⅝" x 10" x 14'

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. . . **A new guide** presenting drawings and photographs with detailed explanations of 90 per cent of all the key designs used in tools for presswork.

. . . **Hundreds of sketches,** complete drawings and photographs made by recognized leaders in the field show the work—the die—the method of manufacture.

. . . **Clearly presented** mathematical formulas, necessary for the successful engineering of a die sequence come to you in practical, usable form.

DIE ENGINEERING LAYOUTS and FORMULAS

By C. W. HINMAN

Former Chief of Jig and Fixture Design, Western Electric Co., Chicago; former Chief Tool Engineer, Automatic Electric Company, Chicago.

497 pages, 6 x 9, 366 illustrations, $5.00

A PRACTICAL toolroom engineer brings you in this new book the gist of his 40 years' experience in interchangeable manufacture. Here are drawings and photographs with detailed explanatory text of 90 percent of all the key designs used in tools for presswork. The book includes all the necessary mathematical formulas for laying out the assembled dies in a clearly rendered drafting technique—shows dies for producing war equipment that reveal basic principles of many key designs that will have wide application in fabricating an endless variety of small precision parts after the war—shows you the drafting short-cuts that war production has worked out. Nearly all the tool designs are complete working drawings from which many of the tools described, or similar ones, could be built from the dimensions given.

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- etc., etc.

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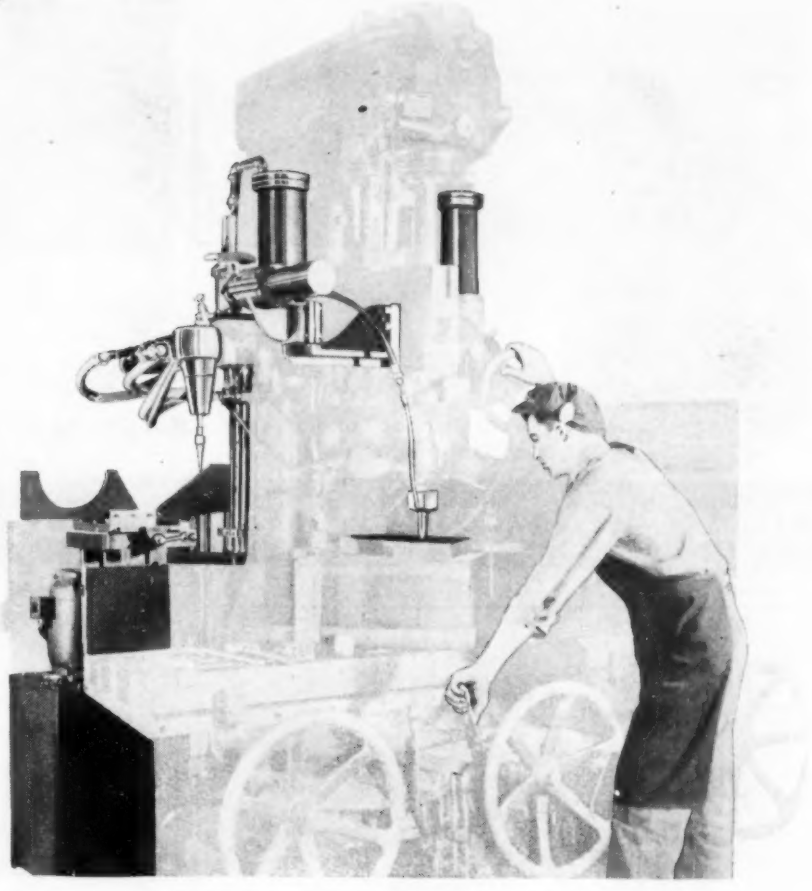

DIE SINKING, one of the more difficult machining operations in any plant, is a comparatively simple task when the plant is equipped with a Turchan Follower.

Shown herewith is a Turchan Follower attached to a Reed-Prentice No. 5 mill. This Turchan equipped machine, located in one of the largest drop forge plants in the United States, is in almost constant use machining airplane engine crankcase dies.

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Turchan Followers, on the other hand, do not interfere with normal use of the machine. The one pictured here can be disengaged by removing two nuts. The operators of this equipment are saving time, money and reject worries by *Turning to Turchan* You, too, can *Turn to Turchan* and do likewise. Send for our new booklet today and let our engineers explain Turchan all hydraulic duplicating to you.

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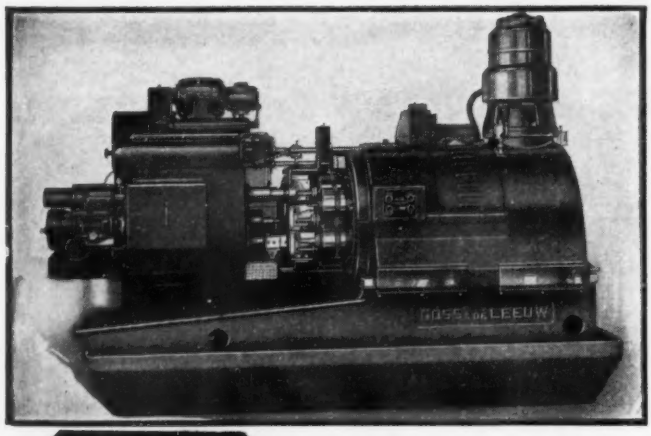

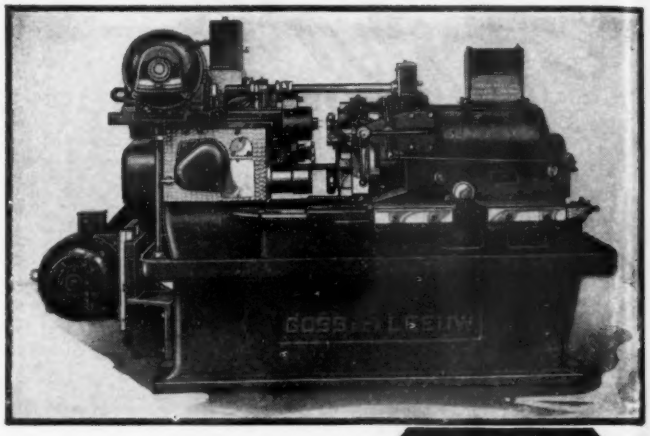

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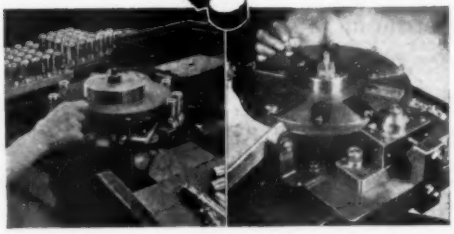

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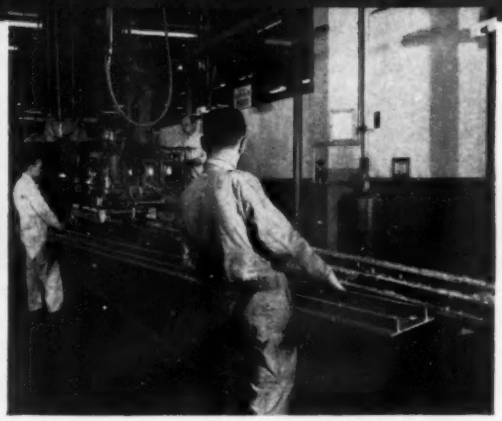
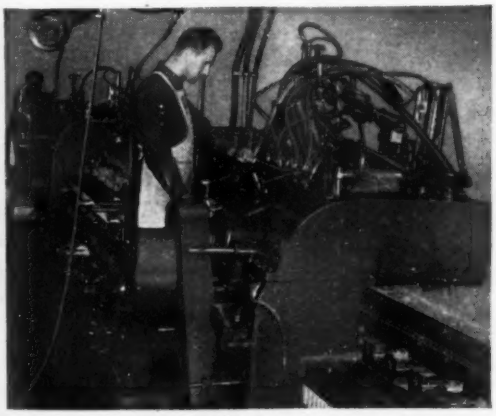


20′ channel beams and 8′ and 10′ cap strips are milled on this 30′ machine. A 45′ Onsrud A80-A can handle parts up to 38′ long. A 60′ machine will soon be completed for machining parts up to 48′ long in one set-up.



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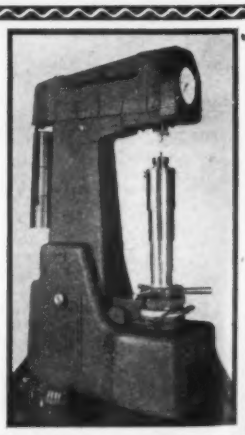

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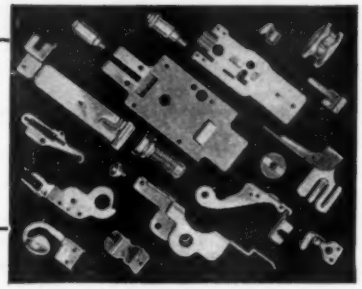

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STEEL PRODUCTS CO.
1103 E. 23rd St. INDIANAPOLIS, IND.

Designers of
Tools, Jigs, Fixtures and Gages
Methods and operation sheet engineers 25 years experience.
The Rein Manufacturing Co., Inc.
216 East 26 Street, New York City, N. Y.
MUrray Hill 3-9462

WIRE AND METAL SPECIALTIES
In round, flat, square and special shaped wire in all metals.
LARGE PRODUCTION CAPACITY
Plating and finishing.
EASTERN TOOL & MFG. CO.
BLOOMFIELD, N. J.

HAVE FACILITIES OPEN FOR
COMPLETE MACHINING AND ASSEMBLY OF SMALL UNITS.
ALSO SMALL CASTINGS AND PRECISION PARTS.
WE DO OUR OWN TOOLING AND CAPABLE OF ENGINEERING IF NECESSARY.
IN SURPLUS LABOR AREA.
MODERN EQUIPMENT COMPANY
302 3rd St. NW, Cedar Rapids, Iowa
IN WAR WORK SINCE PEARL HARBOR

MORE WORK WANTED
Modernly equipped, efficiently manned, small machine shop with excellent reputation, now engaged in building precision instruments to blueprint, also experienced in production, has part facilities available for additional work.
KERN COMPANY, Two John St., New York

Complete Engineering Service
Consulting, Patent, Management, Plant Layout, Processing, Design & Build Automatic Machinery, Jigs Fixtures, Tools, Dies, Patterns, Cast Iron Castings.
EMPIRE ENGINEERING
1700 Elmwood Ave. Buffalo, N. Y.

SILK SCREEN SPECIALISTS
FOR INSTRUMENT PANELS AND MECHANICAL DEVICES
Equipped to handle the design, screens and production
MELVIN DOUGLAS
53 W. Jackson Blvd. Chicago

DESIGN & BUILD JIGS, FIXTURES & GAGES
REED MACHINE & TOOL ENG.
BOX 662
PAWTUCKET, R. I.

KIRK & BLUM
CONTRACT MANUFACTURING
ACCURATE SHEET STEEL
STAINLESS STEEL, MONEL OR OTHER ALLOY FABRICATION
OUR SPECIALTY
CAPACITY 1/8" AND LIGHTER
THE KIRK & BLUM MFG. CO.
2823 SPRING GROVE AVE. CINCINNATI, OHIO

DOES IT WORK?

Is advertising in the Contract Work Section helping *American Machinist's* subscribers and readers find outside help when they need it? Does advertising in this section really do its job?

If you have idle equipment to put to work, you will want the answers to these questions. You can get them quickly by addressing CONTRACT WORK DEPARTMENT, *American Machinist*, 330 West 42d St., New York, N. Y.

Gray Iron and Semi Steel Castings, also alloyed with nickel, chrome, and molybdenum. Wood, Iron, Brass and Aluminum pattern work.
KING FOUNDRIES, INC.
Phone 823 North Wales, Montg. Co., Pa.
22 Miles from Philadelphia, Pennsylvania

MACHINE SHOP
Facilities include 9" South Bend Bench Lathe, #2 Brown & Sharpe Milling Machine, Drill Press and 8"x8" Shaper. The usual line of hand tools and equipment plus experienced workmanship assure your satisfaction. Your inquiries invited.
C. VANDEGRIFT CO. HOCKESSIN, DELA.

PRODUCTION SURFACE GRINDING
AUSTIN P. CULLON
TOOL & ENGINEERING
2926 Biddle Ave. Wyandotte, Mich.

AUTOMATIC SCREW MACHINES
Large production capacity on several Gridley, Four Spindle, up to 1¾" Diameter New Britains, Six Spindle, up to 1⅝" Diameter
Our skilled mechanics are a guarantee of your satisfaction. Send prints or samples for quotations on large quantities.
VETOOL MFG. CO. INC.
401 Broadway New York, N. Y.

PATTERNS in WOOD and METAL
For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us – we will take care of them.
GENERAL PATTERN WORKS
2233 Buck Street Cincinnati, Ohio

SEARCHLIGHT SECTION

POSITIONS VACANT

These Positions Vacant advertisements are published subject to agreement by the advertisers not to consider applicants now employed on war work unless they obtain written release from present employer.

MECHANICAL DRAFTSMAN with practical mechanical experience in blanking, drawing and forming dies for sheet aluminum products in defense plant in Midwest; give experience and full particulars. P-593, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

TOOL MAKERS for defense plant in Midwest; give experience and full particulars. P-594, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

FIRST CLASS ENGINEER experienced in machine tool design; practical experience desired. For man who can assume responsibility this is a good opportunity now and after war with leading machine tool builder. P-595, American Machinist, 330 W. 42nd St., New York, N. Y.

MACHINE TOOL SALES ENGINEER for leading company in East excellent opportunity for competent Tool Engineer with full knowledge of application of all types of machine tools. Actual sales experience desirable, but not absolutely necessary. Salary basis. P-596, American Machinist, 330 W. 42nd St., New York, N. Y.

GRINDING WHEEL SALES ENGINEER. Expanding, well-known New England grinding wheel manufacturer has opening for draft-exempt man with mechanical background. Salary $300.00 a month plus expenses and bonus. All replies will be considered confidential. P-597, American Machinist, 330 W. 42nd St., New York, N. Y.

WANTED Machine Shop Foreman for small shop employing 25 men. Give references and experience. P-598, American Machinist, 330 W 42nd St., New York, N. Y.

ENGINEER—Research and Development by pump manufacturer, near New York. Diversified experience in high pressure hydraulic and low pressure rotary pumps. This job is long range research and development for both war and post war. Give full particulars in first reply, confidential, permanent. Write P-606, American Machinist, 330 W. 42nd St., New York, N. Y.

ENGINEER, to carry-on, direct and expedite the development of new Mechanical Processes, Tooling and Electric Powered Machines and equipment. P-607, American Machinist, 330 W. 42nd St., New York, N. Y.

WANTED—Experienced Process Engineer to design tools and write up operation sheets. Familiar with automatic machines and modern production methods. Rhode Island Plant with post war possibilities. Write P-698, American Machinist, 330 W. 42nd St., New York, N. Y.

WANTED—Men in metal working industries to sell at good profit important machine shop manual to coworkers. Write for details to Mr. F. Dickman, 326 W. 42nd St., New York City.

EMPLOYMENT SERVICE

SALARIED POSITIONS — This advertising service of 33 years' recognized standing negotiates for high salaried supervisory, technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. Bixby, Inc., 266 Delward Bldg., Buffalo, N. Y.

POSITIONS WANTED

AMERICAN ENGINEER, Master Mechanic with broad experience in products, machines and tool design for low cost and high production, age 57 can organize, supervise and train others, 40 years experience. PW-577, American Machinist, 330 W. 42nd St., New York, N. Y.

PRODUCT ENGINEERING work desired. Twenty years experience on designing, checking, drafting, production, and cost work. Pennsylvania or Ohio preferred. PW-609, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

AUTOMATIC-SCREW-MACHINE EXPERT. Experienced on Swiss Automatics, Brown and Sharpe, Cleveland and Multiple Spindle Automatics. Able to lay out cams for Swiss and Brown and Sharpe Automatics. 22 years experience. Age 40. Married, 2 children, citizen. Likes to locate in Connecticut. PW-610, American Machinist, 330 W. 42nd St., New York, N. Y.

Position open for graduate mechanical engineer

in Production Engineering Department of large firm with 43 years of manufacturing experience.

Some aviation production experience desired, but not required. Prefer a man 30 to 35 years of age. Good opportunities for advancement. Write

L. A. HIBBS
Executive Engineer
250 North St. Francis, Wichita, Kansas

(POSITION VACANT)

An old well established manufacturer of medium size, whose prewar products (fabricated from castings, bar stock and sheet steel all of which are heat treated in processing) are now used 100% in vital war equipment, would like to interview an experienced man 35 to 45 years old who could fit permanently into the organization an an executive capable of assuming responsibility for plant production, engineering and some sales engineering. Salary commensurate to experience and ability to produce satisfactory results.

P-590, American Machinist
520 No. Michigan Ave., Chicago, Ill.

CHIEF TOOL ENGINEER WANTED

By a large tool and die company, located in the middle west, with an engineering department employing over 100—doing 100% war work, with excellent opportunities for post war work. Must have a thorough knowledge of standard and special tooling, jigs, fixtures, gauges, special machinery, and be capable of producing results. State age, education, experience. Also enclose photograph in first letter.

P-614, American Machinist
520 No. Michigan Ave., Chicago, Ill.

MANUFACTURER'S REPRESENTATIVE

We have a conveniently located Warehouse in New York City and a long-established, aggressive organization. We cover Philadelphia, New Jersey and New York.

At present we handle a nationally known clamping device and are interested in adding outstanding accessory tools, or similar products sold through tool designers, shop superintendents, etc.

Our intensive selling methods require an exclusive arrangement and we are sure results will justify this. Warehouse stocks are bought by us (not consigned) and are sold in strict accordance with prices and policies of manufacturer.

If interested in effective, permanent representation for all or part of our territory, write

RA-588, American Machinist
330 West 42 St., New York City

POSITIONS WANTED

MACHINE TOOL MAN 25 years experience prefers position with good rebuilding firm where his services could be used on selling, buying, design, etc. Has special repair proposition. PW-613, American Machinist, 330 W. 42nd St., New York, N. Y.

SELLING OPPORTUNITIES
OFFERED—WANTED
Selling Agencies—Sales Executives
Salesmen—Additional Lines

OPPORTUNITY WANTED

SALES REPRESENTATIVE for state of NEW JERSEY. One or two non-competitive accounts wanted in metal-working machinery or accessories. Established office and contacts. Graduate engineer competent and experienced in technical service-sales. SA-611, American Machinist, 330 W. 42nd St., New York, N. Y.

PATENT ATTORNEY

PATENTS, COPYRIGHTS. Booklet, "General Information Concerning Inventions and Patents" and "Fee Schedule" sent without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 453, 815-15th St., N.W., Washington, D. C.

CONTRACT WORK

WORK WANTED — For advertisements of work wanted see page 263.

WANTED

SALES MANAGER

Gear manufacturing concern with nationwide market offers exceptional opportunity to man with experience in marketing industrial and marine gear products. Acquaintance in New York and Washington, D. C. essential. Must be capable of administering activities of commercial department. State age and experience including present connection.

SW-615, American Machinist
330 W. 42nd St., New York, N. Y.

AGENTS WANTED

"Toolife" Cutting Oil Agents wanted throughout U. S. for specialized sulphurized and non-sulphurized compounds.—increased tool life over 20% proven—no dermatitis—must be acquainted with trade—state experience, details.

AW-581, American Machinist
330 W. 42 St., New York City

PROFESSIONAL SERVICES

BRIGGS-EVANS
Engineering Consultants
Specialists in Design & Methods
High Production
Dies, Tools, Jigs, Special Machine
We know how best to do
what you would like to do
60 STATE ST., BOSTON, MASS.

Engineering and Research Co.
MACHINE DESIGNERS
MECHANICAL ENGINEERS
High Production Dies, Tools, Jigs and Fixtures, Methods, Job Analysis, Consultants and Supervisors, Industrial Engineering and Research
Chatham Phenix Building, 29-28 41st Ave.
Long Island City, New York

WANTED

NEW PRODUCTS—OLD PRODUCTS

PREPARE NOW FOR POST WAR BUSINESS

A 32-year old corporation, now producing 100% War Production employing 4000 persons, desires to contact established firms or reputable individuals having products for post-war manufacturing or promotion.

We offer the facilities of a large well equipped plant, efficient Management, trained Engineering and Production supervision, capable of designing and developing Tools, Dies, Jigs, Fixtures plus adequate machinery to fabricate and assemble anything made from sheet metal. We also offer the facilities of a complete textile fabricating division having all new equipment consisting of 300 sewing machines, cloth laying machines, cutting and perforating equipment capable of fabricating any article made from wool, cotton, silk or Nylon.

We would be interested in the development of new enterprises, possible outright purchase or manufacturing on contract; we can assure the fullest cooperation in producing any meritorious product old or new.

All communications will be considered in strictest confidence. Address replies attention of:

BO-603, American Machinist
520 No. Michigan Ave., Chicago, Ill.

IF YOU ARE DOING DEFENSE WORK

Send for Our Latest Circular Covering Bargains in Small Tools Such as Drills, Reamers, Turret Attachments, etc.

DEWITT TOOL COMPANY
173 Grand St. New York City

1—**Cleveland Automatic Screw Machine**, Model A—3¼ inch—Motorized
1—**Cleveland Screw Machine**, Automatic, Single Spindle, 2", Model B—Motorized
1—**Hartford Screw Machine** Automatic—⅝" capacity
4—**Production Mill Machines** #2, Pratt & Whitney
4—22" Swing 6 Hole Turret Geared Head **Chucking Lathes**
1—**Gisholt Turret Lathe**—1½ Spindle—14" Swing Power Feed
1—**Bickford** Heavy Duty **Radial Drill**, 3 Ft. Swing
1—**Gray Planer**—24" x 24" x 6'
1—**Rahn & Carpenter Engine Lathe**, 24" x 12' Bed with 24" Independent Chuck

RODALE MFG. CO., INC.
EMMAUS, PA.

WANTED

A post-war product to be manufactured by large metal working plant. Patented articles or those having merit will be considered.

BO-604, American Machinist
520 No. Michigan Ave., Chicago, Ill.

SMALL MACHINE SHOP

FOR SALE

Write for Descriptive Circular

BO-592, American Machinist
330 West 42nd St., New York City

FOR SALE

GEAR MACHINERY

No. 36 B. M.—G & E—3 spdl. Gear Rougher
(2) David Brown (England) Worm Gear Grinders
15" Gleason Spiral Gear Generator
14" Fay Automatic Lathe
Good condition—"priced very low"

GLOBE TRADING COMPANY
920 W. Lafayette Blvd., Detroit, Mich.

Notice to Advertisers

Because of the Holiday, Independence Day, July 4th, observed July 5th, the "Searchlight" pages of the

JULY 8th ISSUE OF

AMERICAN MACHINIST

close for press earlier than the usual weekly closing time.

The cooperation of advertisers is solicited in forwarding new copy, or changes of copy, to reach us accordingly.

FINAL CLOSING TIME
Display and Undisplayed Ads:
Friday 10 A.M., June 25th.

THE NICHOLS TABLE OF SCREW THREADS AND TAP DRILLS
$1.75

Now is the time to order your copy. One table, 60 PAGES long, listing all standard screw threads with essential thread data.

THE NICHOLS CO. 1213-K St., S-W., Cedar Rapids, Ia.

NEW INVENTIONS WANTED

Mechanical and electrical devices which can be used to promote our war production program. Either new ideas, or improvements upon present methods.

P. O. Box 217, Denville, N. J.

FOR SALE

BORING MILL

Bullard 42" Vertical Boring Mill. Two heads on rail, one swivel. Complete with all equipment including Motor Drive, ready to run. Reconditioned for precision work.

FRANK D. SAYLOR & SON
13095 Greeley Avenue Detroit, Michigan

"A FROZEN ASSET IS A LIABILITY"

Our Services Are Available

to Buy or Sell:

- Manufacturing facilities; operating or idle, with or without inventories and intangibles.
- Surplus machinery, plants or inventories.

Confidential negotiations.

ASSET REALIZATION CO.
21 EAST 40TH ST., NEW YORK

FOR SALE

14—20 and 85—23 Gardner Grinders, double opposed discs—including fixtures. Guaranteed like new.

AUSTIN P. CULLON
Tool and Engineering
2926 Biddle Ave. Wyandotte, Mich.

FORGING HAMMERS

1000 lbs. Erie Steam Drop
800 lbs. Erie Steam Forging
600 lbs. Potter McDougall Steam Forging
500 lbs. Chambersburg Steam Forging
All in very good condition

FS-612, American Machinist
330 W. 42nd St., New York, N. Y.

WANTED

PRESS

200 to 300 Ton Double Back Geared Straight Side Crank Press, Stroke 12" or more.

W-605, American Machinist
520 North Michigan Ave., Chicago, Ill.

IN STOCK!!!

"FALK" for DEPENDABILITY in Rebuilt Machinery

LANDIS GRINDER

10x36 Landis Plain Grinder Self contained. Complete with Chuck. Back Rests and Centers.

MILLING MACHINES

No. 4 LeBlond Heavy Duty Plain Miller with power rapid traverse, and vertical milling attachment, belt drive, double back geared, table working surface 16x62, Serial No. 1269.

P & W Duplex Miller No. 2.
Sanford No. 1½ Production Miller, Rotary Table.
Cleveland Vertical Miller No. 1 (New).

GEAR CUTTERS

No. 1 Adams Farwell Gear Hobber, complete.
No. 2 Whiton Spur Gear Cutter, Auto.
1—No. 3 Barber Colman Gear Hobber.
Van Norman No. 1 Pinion Cutter.
No. 12 Barber-Colman Gear Hobber.

SHAPERS AND SLOTTERS

26" Cincinnati Triple Geared Shaper, Friction Drive.
20" x 20" x 36" N-B-P Shaper-Planer, Arranged Motor Drive.
12" New Haven Slotter.
16" Kelly Back Geared Crank Shaper, cone drive.

PRESSES, BRAKES & SHEARS

MARIETTA Power Press Brake 104" between uprights. Dual rams to permit operations on separate dies from both sides of press. Bed area 20" x 104", each ram 6¼" x 98". 4" crank shaft, 3" stroke. Excellent condition.
Ohl power press brake 8' x 3/16 cap.
Ohl power square Shear 8' x 3/16 cap.
Niagara No. 135 Deep Throat Punch Shear, Hydraulic Wheel Press 200 tons, 42" between strain bars, self-contained, belt drive.
Niagara 36" foot Shear, 16 ga.
Kutscheid all steel 36" x 16 ga. Foot Shear.
Pittsburgh 36" x 3/16" Plate Shear, no holddown.
No. 132 Bliss 14 ga. 12" throat Slitter.
No. 232 Bliss 12 ga. 18" throat Slitter.

RADIAL DRILLS

2—Niles-Bement-Pond, box column 5' arm.
1—Niles-Bement-Pond, box column 6' arm.

TURRET LATHES

21" Gisholt Universal Turret Lathe with 3⅝" hole in spindle, 2-step cone for 5" belt.
Jones & Lamson 3x36 Double Spindle, air chuck equipment.
Jones & Lamson 3 x 36 Single Spindle, Geared Head, Single Pulley Drive.

COILING MACHINES

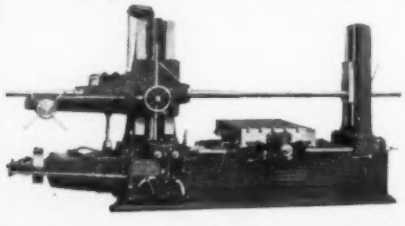
No. 1 and No. 2 Sleeper & Hartley BX cable coiling machine, ⅝ and ½ in. capacity. Last used for speedometer cable. Complete.

GRINDERS

No. 6 Besley Double Opposed Disc Grinder.
No. 2 and No. 3 Brown & Sharpe Cutter Grinder.
Taft-Peirce Automatic Pin Grinder.
Badger No. 2 Double End Disc Grinder 16" disc, ball bearing, spindle, Universal table.
Gardner No. 1 double end Disc, 12" Ball Bearing belt drive.
Gorton, double end Disc Grinder, 18" discs.
Seller Tool Grinder.
Greenfield No. 2 Universal Tool & Cutter Grinder, complete equipment.

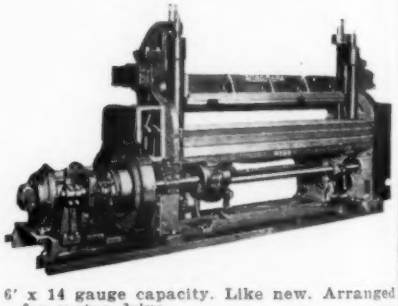
#32 LUCAS "PRECISION"

Boring—Drilling and Milling



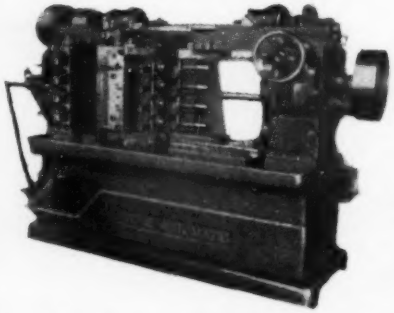
Lucas #32 precision horizontal boring, drilling, and milling machine. 3¾" Bar. Extra length bed and table. Silent chain motor drive. 7½ H.P. G.E. 3 ph., 60 cy., 440 v. Push button control. Fully Guaranteed.

#98 NIAGARA



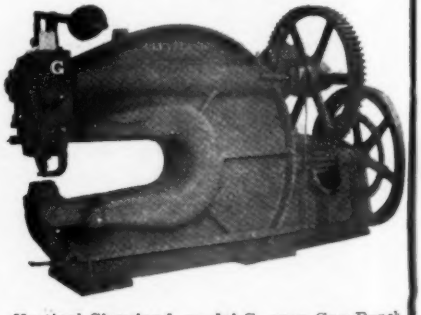
6' x 14 gauge capacity. Like new. Arranged for motor drive.
Working length 72", cap. 14 gauge; min. width of fold at cap. 1" gaging range (narrow folds) ⅜" to 1⅝", max. gaging range 72" left of chamfering bar 3". Shipping wt. 12,690 lbs.

1¼" CONE AUTOMATIC



This machine is primarily for cutting off bar stock, or tubing. Can be arranged for light forming, chamfering and drilling operations.
Size 1¼" round; 1 5/64 hex; ⅞ sq. max. feed 12" wt. 10,000 lb. with 15 H.P. motor.

MODEL G CLEVELAND



Vertical Cleveland, model G, open Gap Punch. 52" throat, arch Jaw, 2" hole thru 1" plate cap. arranged for Gear motor drive. 10 H.P. 3 ph., 60 cy., 220 v.

Every Item Guaranteed

FALK MACHINER CO

COMPANY MI

18 WARD ROCH

ORDER NOW!!!

"FALK" for DEPENDABILITY in Rebuilt Machinery

LATHES

Putnam 30" x 12' Heavy Duty Screw Cutting Engine Lathe, Quick Change Gear.
Putnam 26" x 12' Heavy Duty Screw Cutting Engine Lathe, Quick Change Gear.
30" x 18' Prentice Plain Change Lathe, with raising blocks to swing 42", belt drive.
20" x 16' Reed Light Type Plain Change Screw Cutting Engine Lathe.

24" Bullard Vertical Turret Lathe Rapid Production, motor drive.
30" Colburn Vertical Turret Mill, M.D.
3½" Rochester Floor Type Horiz. Boring Mill, M.D.

18" x 12' Hamilton Plain Change Lathe.
19" x 8' LeBlond Heavy Duty Production Turning Lathe.
18 x 6 South Bend Plain Change Lathe.
16 x 8 American Quick Change Gear Lathe.
16 x 6 South Bend Plain Change Lathe.
14 x 6 Reed Lathe, Plain Change, motor drive.
16 x 8 American Quick Change Gear.
16 x 8 Hendey Tool Room, with Taper att.
18 x 8 Superior Heavy Duty.
18 x 12 Champion Tool Wks. with Taper and Collets.

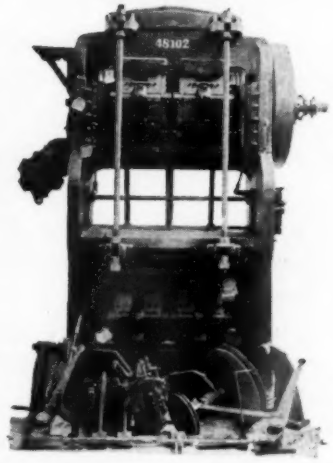
INTERNAL GRINDER

Greenfield No. 12, Hydraulic Feed, motor drive; cap. swings 15", Grinds automatically ¾" to 5" dia., 4" deep, New in 1928.

CONCO ELECT. HOIST

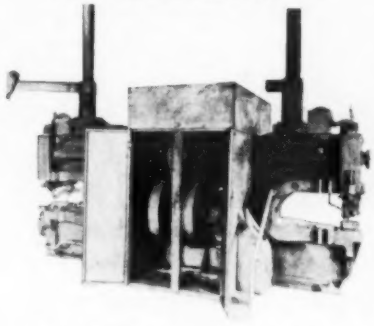
Conco 250 lbs. Elect. Hoist $139.50
Conco 500 lbs. Elec. Hoist $149.50 ea.
Conco 1000 lbs. Elec. Hoist $159.50
New Hoists for Defense Plants

310S BLISS



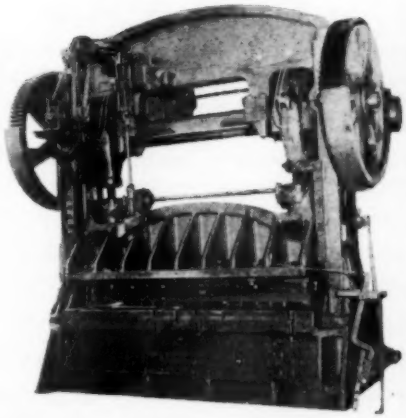
Bliss 310S Automatic Gang press. For rapid accurate production from ribbon stock, small sheet steel or sheet brass articles. 180 Finished Blanks per min. Does eight operations at once. Dies operate an independent sub-press. Tie rod frame.

1¼" WICKES PUNCH



Wickes Double End Punch and Shear 1¼" hole thru 1¼" plate cap.; Punching end 48" throat, Shearing end 36" throat, continuous 6" x 1" plate.

TOLEDO 94½-J



TOLEDO 94½-J 200 ton press. Straight side, tie rod, double twin, direct geared M.D. with 30 H.P. 3 ph. 60 cy. 440 V. motor & con. Forced feed lub., pneumatic controlled friction clutch & brakes. Bed area—120" right to left x 50" front to back. 12" stroke, 18" sheet height. Bed equipped with spring cushions. Weight approx. 80,000 lbs.

DRILLING MACHINES

Fox #15H multiple spindle drilling machine. Hydraulic feed, with 35 #1 Morse taper Spindles, 17" x 34" head, serial No. 1065. Motor drive 10 H.P., 3 ph., 60 cy., 220 v.

Fox #D31 multiple spindle drilling machine. Drilled for 32 spindles and equipped with 16 #2 Morse taper. Power feed, 17" x 34" head, Serial No. 626, motor drive 10 H.P., 3 ph., 60 cy., 220 v.

Natco #12 multiple spindle drilling machine. Single pulley, Belt drive, Drilled for 16 Spindles and equipped with 6 #2 Morse taper. Power feed.

PROFILERS

Pratt & Whitney No. 12 two-spindle motorized Profiler. Table 12" x 15" equipped with 6" raising blocks, and 5 H.P., 3 phase, 60 cycle, 220 V motor —Turner drive mounted and wired to push button control—rebuilt and guaranteed.

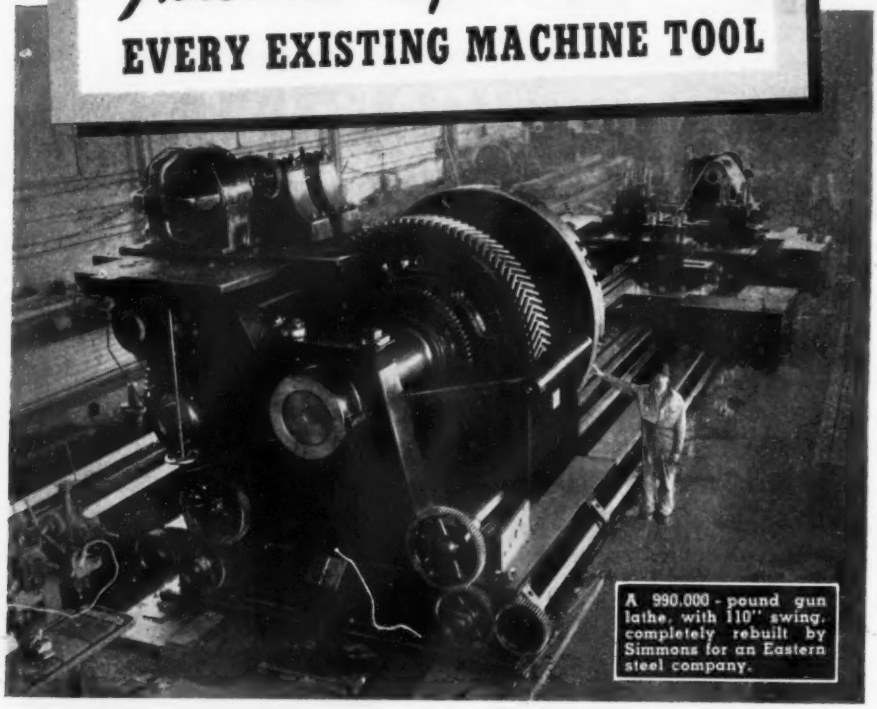
200 TON NIAGARA

1—Niagara #612 D press. Straight side, double crank, back geared, 200 ton cap., 3" stroke, bed 60 x 38

FALK COMPANY
MERCHANTS
ROCHESTER, N. Y.

Telephone MAIN 6347-8

First in importance—
EVERY EXISTING MACHINE TOOL



A 990,000-pound gun lathe, with 110" swing, completely rebuilt by Simmons for an Eastern steel company.

ARMY E NAVY

Awarded to the employees of Simmons Machine Tool Corp. August 20, 1942. Service star awarded February 13, 1943.

VICTORY hangs in the balance as the Battle for Production —United Nations versus Axis—proceeds apace. Just as it is vital that every available striking unit be brought into front-line action, it is the MUST of the hour that every machine tool be concentrated on the production line.

Simmons *Engineered Rebuilding* has been used by key war plants to rebuild and modernize long-idle equipment. Giant gun lathes weighing 495 tons (see above photo) rusting since 1918, have been completely rebuilt in fractions of the time needed to build similar new ones. They are now turning out the tools and weapons of war . . . because Simmons "can do it."

Over 30 years of experience are at your disposal. We can bring idle equipment out of storage and make it strike again. There still is equipment not yet answering the "call for production." Consult Simmons at once on your rebuilding problem.

IN STOCK

Every machine listed in this column is in our warehouse at press time.

No. 3 WARNER & SWASEY Universal Hollow Hex. Turret Lathe, 3 1/8" capacity, Belt or Motor Drive.

42" PUTNAM Double End Car Wheel Lathe, M.D.

6" x 6" x 5/8" Double Angle Shear.

Beam Shear 20", 60# and smaller.

60" Throat 8" x 1 1/16 Shear.

54" Throat 1 3/4" x 1 1/8" Punch.

6" BILGRIM Bevel Gear Generator.

15" GLEASON Bevel Gear Generator.

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54" Colburn, M. D., 2 heads
36" Bullard, Niles 2 heads
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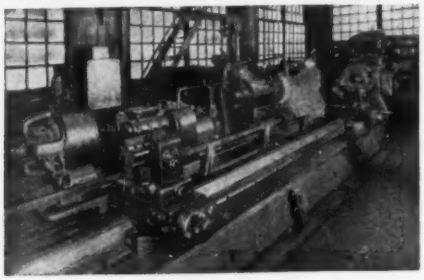

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18H Gould & Eberhardt Gear Hobber.
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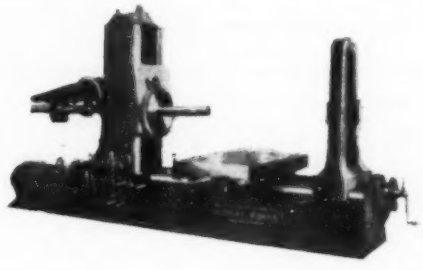

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11" Gleason Bevel gear generator
Cimatool gear chamfering M.D.
Lees-Bradner Gear Grinder

TURRET LATHES

6x6½" Goss & DeLeeuw

MISCELLANEOUS

8" Bullard Multimatic M.D.
36'x36"x8' Woodward & Powell Planer Rev. M.D.
Lees-Bradner Spline Hobber 6"x54"

DRILLS

New Delta Drilling Equip.
4 Spindle Taylor & Finn, M.D.

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#0 and #00 B. & S.
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Gridley, Single Spindle, 2¼" cap.
#55 National Acme, 1⅝" Cap. M.D.
#52 National-Acme, ¾" Cap. 4 Sp. M.D.

BORING MILLS
42" Bullard Vertical, 2 Heads on rail
42" Bausch Vertical, 2 Heads on rail
30" Flather, Swivel
4" Bickford Horizontal, Single Pulley

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Modern, Cylindrical, 16x60" M.D.
Diamond Surface, 12x14x54" M.D.
Diamond Surface, 16x16x56" M.D.
Norton, Cylindrical, 6x32" M.D.
Storm, 8x10" M.D.
Universal Tool & Cutter 6x34".

LATHES
Monarch, 18"x16' G.H. Motor in base, taper, rapid traverse.
Putnam, 38"x16' M.D. Motor and controls
Lathe & Morse, 26"x12'
Rahn & Larmon, 18"x36"x8' Q.C. Taper
Leblond, 14"x6'. M.D.

MILLERS
#5B Brown & Sharpe, Table 22x82"
#3 Hendey, Table 13"x48"
Garvin-Duplex, Table 12x64"
#12 Brown & Sharpe Production
18" Cincinnati
#7 Beckers
Becker Vertical, Model AB

PLANERS
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TURRET LATHES
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Jones & Lamson, 2x24" M.D.
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Pratt & Whitney, 1½" cap.

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Schatz Angle Shear, 1" Cap.
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#17 Williams & White Heavy Duty Punch, 36" Throat
Geo. A. Ohl Power Shear, 10'. 14 Gauge
#11 Pratt & Whitney Profilers, 2 Sp.
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ADVERTISERS INDEX

	Page
Abbott Ball Co	198
Abrasive Machine Tool Co	216
Acme Machine Tool Co	32b
Acromark Corp.	246
Adams Company	192
Aladdin Rod & Flux Mfg. Co	176
Alexander Hamilton Institute	238
Allegheny-Ludlum Steel Corp	162
Allis-Chalmers Mfg. Co	77
Almond Mfg. Co., T. R	230
American Chain & Cable Co., Inc.	256, 258
American Cutter & Engineering Corp.	236
American Magnesium Corp	48
American Optical Co	182
American Screw Co	151
American Tool Works Co	16
Ampco Twist Drill	124
Armstrong-Blum Mfg. Co	42
Armstrong Bros. Tool Co	32c
Arter Grinding Machine Co	224
Atlantic Machinery Corp	204
Atometric Precision Gage Laboratories, Inc.	214
Automatic Machine & Tool Co	214
Automotive Maintenance Machinery Co.	229
Auto-Ordnance Corp.	75
Avey Drilling Machine Co., Inc	241
Baker Bros., Inc	217
Bakewell Mfg. Co	233
Baldwin-Southwark Div. Baldwin Locomotive Works	137
Barber-Colman Co.	64
Barnes Drill Co	232
Barrett Co., Leon J	196
Baumbach Mfg. Co., E. A	252
Bilgram Gear & Machine Works	196
Bissett Steel Co	190
Blake Co., Edward	204
Blanchard Machine Co	43
Blank & Buxton Machinery Co	172
Blount Co., J. G	212
Bodine Corp.	239
Boker & Co., Inc., H	176
Boyar-Schultz Corp	226
Braun Gear Co	196
Breuer Electric Mfg. Co	262
Brewster-Squires & Co	198
Bridgeport Safety Emery Wheel Co	210
Bristol Co.	151
Brown & Sharpe Mfg. Co	165
Bryant Chucking Grinder Co	41
Buhr Machine Tool Co	234
Bullard Company	53
Burke Machine Tool Co	250
Butterfield Co., Div. of Union Twist Drill Co.	72
Cadillac Gage Co.	54
Campbell, Andrew C., Div. American Chain & Cable Co., Inc	258
Carboloy Co., Inc	127
Carborundum Co.	183
Card Mfg. Co., S. W	73
Carlton Machine Tool Co	232
Central Screw Co	151
Century Electric Co	163
Chandler Products Corp	151
Chaso Tool Co	246
Cincinnati Bickford Tool Co	79
Cincinnati Electrical Tool Co	228
Cincinnati Gear Company	194
Cincinnati Grinders, Incorporated	10, 11
Cincinnati Lathe & Tool Co	214
Cincinnati Milling Machine Co	4, 5
Cincinnati Planer Co	248
Cities Service Oil Co	185
Clearing Machine Co	69
Cleveland Crane & Engineering Co	255
Cleveland Hobbing Machine Co	58
Cleveland Punch & Shear Works Co	70
Cone Automatic Machine Co., Inc	37
Continental Screw Co	151
Corbin Screw Corp	151
Coulter Machine Co., James	248
Covel Mfg. Co	44
Crafts Co., Inc., Arthur A	226
Criterion Machine Works	204
Cross Gear & Machine Co	65
Cullen-Friestedt Co.	176
Cushman Chuck Co	235
Dalzen Tool & Mfg. Co	205
Danly Machine Specialties, Inc	202
Davis Keyseater Co	250
Dayton Rogers Mfg. Co	257
Dearborn Gage Co	142
Desmond-Stephan Mfg. Co	224
Detroit Die Set Corp	256
Detroit Tap & Tool Co	135
DeVlieg Machine Co	74
Dow Chemical Co	167
Earle Gear & Machine Co	193
Eastern Machine Screw Corp	202
Eclipse Counterbore Co	164
Errington Mechanical Laboratory	242
Etna Machine Co	254
Ex-Cell-O Corp.	34, 35
Federal Bearings Co., Inc	60
Fellows Gear Shaper Co	8, 9
Fidelity Machine Co	194
Fitchburg Grinding Machine Corp	33
Fosdick Machine Tool Co	38
Fray Machine Tool Co	154
Gallmeyer & Livingston Co	260
Ganschow Gear Co	196
Gardner Machine Co	223
Gear Specialties, Inc	193
General Electric Co	30, 56
General Machinery Corp. (Mass.)	226
General Machinery Corp. (Ohio)	40
Geometric Tool Co	252
Gisholt Machine Co	51
Gleason Works	3
Goss & deLeeuw Machine Co	260
Grant Gear Works	194
Grant Mfg. & Machine Co	256
Gray Co., G. A	243
Greenfield Tap & Die Corp	186
Grobet File Co	220
Gulf Oil Corp	153
Hall Planetary Co	250
Hamilton Tool Co	232
Hanna Engineering Works	262
Hanson-Whitney Machine Co	152
Hardinge Brothers, Inc	31
Harper Co., H. M	151
Harnischfeger Corp.	168
Hartford Special Machinery Co	196, 242
Haskins Co., R. G	230
Haynes Stellite Co., Div. Union Carbide & Carbon Corp	158
Heald Machine Co	2nd Cover
Hill Acme Co	227
Hobart Brothers Co	176
Hoefer Mfg. Co	236
Holman Reamer Co	230
Hones, Inc., Charles A	178
Horton & Son Co., E	68
Hovis Screwlock Co	197
International Nickel Co	160
International Screw Co	151
James Co., D. O	198
Jefferson Machine Tool Co	202
Johnson Machine Co., Carlyle	194
Johnson Tool Co., Inc	210
Jones & Lamson Machine Co	6, 7
Kearney & Trecker Corp	20, 21
Kempsmith Machine Co	36
Kent-Owens Machine Co	249
Kingsbury Machine Tool Corp	32
Knight Machinery Co., W. B	247
Kux Machine Co	200
Laminated Shim Co	148
Lamson & Sessions Co	151
Landis Machine Co	14, 15
Landis Tool Co	18, 19
Lavalle and Ide Co	232
Leach Machinery Co., H	208
LeBlond Machine Tool Co., R. K	55
Lee Co., K. O	208
Lees-Bradner Co.	52
Leland Gifford Co	230
Lincoln Electric Co	175
Lindberg Engineering Co	173
Link-Belt Co	32d
Linley Bros. Co	244
Littleford Bros.	62
Lodge & Shipley Machine Tool Co	133
Lovejoy Tool Co., Inc	251
Lowe & Sons Co., S	262
Lucas Machine Tool Co	232
Luers, J. Milton	210
McCaskey Register Co	156
McGrath St. Paul Co	178
McGraw-Hill Book Co., Inc	220, 258
McKenna Metals Co	143
Macklin Co.	213
Magnus Chemical Co	161
Matthews & Co., James H	210
Mattison Machine Works	218
Mead Specialties Co	214
Mechanite Research Institute	155
Meisel Press Mfg. Co	192
Metal Carbides Corp	252
Metal Textile Corp	166
Metro Tool & Gage Co	57
Micromatic Hone Corp	46, 47
Mid-West Abrasive Co	28
Midwest Tool & Mfg. Co	222
Mitts & Merrill	246
Modern Tool Works	66

ADVERTISERS INDEX

(Continued from preceding page)

	Page
Mollart Engineering Co., Ltd	238
Monarch Machine Tool Co	24, 25
Moore Special Tool Co	150
Morey Machinery Co., Inc	206, 207, 244, 246
Morris Machine Tool Co	82
Morse Chain Co	195
Morse Twist Drill & Machine Co	219
Murchey Machine & Tool Co	246
Murray Mfg. Co., D. J	254
National Electric Welding Machine Co.	180
National Lock Washer Co	201
National Machine Tool Co	248
National Refining Co	157
National Screw & Mfg. Co	151
National Tool Co	234
Newark Gear Cutting Machine Co	192
New Britain-Gridley Div. New Britain Machine Co.	3rd Cover
New England Screw Co	151
Nichols-Morris Co	244
Nicholson & Co., W. H	212
Nilson Machine Co., A. H	252
Noble & Westbrook Mfg. Co	260
North Bros. Mfg. Co	146
Norton Co.	22, 23
Oakite Products, Inc	178, 208
Oliver Instrument Co	254
Onsrud Machine Works, Inc	261
Osborn Manufacturing Co	225
Ozalid Products Div., General Aniline & Film Corp	221
Parker Co., Charles	151
Parker-Kalon Corp.	151
Pawtucket Screw Co	151
Pheoll Mfg. Co	151
Philadelphia Gear Works	191
Phillips Screw Mfgrs	151
Porter-McLeod Machine Tool Co., Inc.	262
Potter & Johnston Machine Co	27
Pratt & Whitney Div. Niles-Bement-Pond Co.	50
Production Machine Co	234
Producto Machine Co	254
Quaker Chemical Products Corp	131
Quaker City Gear Works	193
Racine Tool & Machine Co	203
Randall & Stickney	250
Reading Screw Co	151
Ready Tool Co	212
Reed-Prentice Corp.	202
Reeves Brothers, Inc	228
Refiners Lubricating Co	190
Reliance Electric & Engineering Co.	189
Republic Drill & Tool Co	231
Republic Steel Corp	184
Revere Copper & Brass, Inc	129
Rivett Lathe & Grinder, Inc.	29
Roberts Rubber Co., Weldon	181
Rockford Machine Tool Co	188
Russell, Burdsall & Ward Bolt & Nut Co.	151
Ruthman Machinery Co	200
Ryerson & Son, Inc., Jos. T	141
Schauer Machine Co	222
Scherr Co., Inc., George	26
Scovill Manufacturing Co	151
Sellers & Co., Inc., Wm	76
Shakeproof, Inc.	151
Sheldon Machine Co	174
Shell Oil Co., Inc	159
Shore Instrument & Mfg. Co., Inc	200
Sier-Bath Gear Co	192
Sigourney Tool Co	236
Simmons Machine Tool Corp	240
Simonds Worden White Co	228
Smit & Sons, Inc., J. K	174
Smith & Mills Co	250
Smith Tool & Engineering Co	200
Sommerfeld Machine Co	211
South Bend Lathe Works	32a
Southington Hardware Mfg. Co	151
Sparks Machine Tool Co	63
Specialties Mfg. Co., Inc	215
Specialty Products Co., Inc	170
Springfield Machine Tool Co	212
Standard Conveyor Co	144
Standard Electrical Tool Co	224
Standard Gage Co., Inc	49
Standard Pressed Steel Co	200
Steelweld Machy. Div., Cleveland Crane & Engrg. Co	255
Sterling Grinding Wheel Div	149
Stevens, Inc., John B	178, 246
Stuart Oil Co., D. A	176
Sturdimatic Tool Co	174
Sundstrand Machine Tool Co	209
Sun Oil Co	78
Swan Finch Oil Co	199
Thompson & Son Co., Henry G	210
Timken Roller Bearing Co (Steel & Tubes Div.)	45, 4th Cover
Torrington Co.	139, 252
Turchan Follower Machine Co	259
Union Carbide & Carbon Corp	158
Union Twist Drill Co	71
Universal Boring Machine Co	230
Universal Engineering Co	230
V. & O. Press Co., Inc	254
Van Keuren Co.	59
Van Norman Machine Tool Co	12, 13, 61
Vascaloy-Ramet Corp.	169
Vickers, Inc.	147
Walker Co., Inc., O. S	226
Waltham Machine Works	242
Warner & Swasey Co	80
Warren Refining & Chemical Co	222
Waverly Petroleum Products	190
Weatherhead Co	170
Webber Gage Co	122
West Disinfecting Co	171
Westinghouse Electric & Mfg. Co.	17, 39, 67, 172, 179
Wheel Trueing Tool Co	240
Whitney Screw Corp	151
Williams Co., J. H	187
Wilson, K. R	253
Wilson Mechanical Inst. Co., Inc	262
Winter Brothers Co.	237
Worthington Pump & Machinery Corp.	177
Wright Mfg. Div. American Chain & Cable Co., Inc	256
Wyckoff Drawn Steel Co	145
Zeh & Hahnemann Co	256
PROFESSIONAL SERVICES	264

SEARCHLIGHT SECTION

Classified Advertising

Classification	Page
BOOKS	265
BUSINESS OPPORTUNITIES	265
CONTRACT WORK SECTION	263
Cullon, Austin P	263
Douglas, Melvin	263
Eastern Tool & Mfg. Co	263
Empire Engineering	263
General Pattern Works	263
Greist Mfg. Co	263
Kern Co.	263
King Foundries, Inc	263
Kirk & Blum Mfg. Co	263
Modern Equipment Co	263
Nilson Machine Co., A. H	263
Reed Machine & Tool Eng	263
Rein Mfg. Co. Inc	263
Reliance Machine & Mfg. Co	263
Thomas & Skinner Steel Products Co	263
Vandegrift Co., C	263
Vetool Mfg. Co. Inc	263
PATENT ATTORNEY	264
POSITIONS VACANT	264
POSITIONS WANTED	264
REBUILDING SERVICE	268, 269, 272
Hill-Clarke Machy. Co	269
Indianapolis Machinery & Supply Co., Inc	272
Simmons Machine Tool Corp	268
SELLING OPPORTUNITIES	264
WANTED TO PURCHASE	265
USED SURPLUS EQUIPMENT	265-274
Aaron Machinery Co	270
Asset Realization Co	265
Atlantic Machinery Corp	273
Canal Machinery Co	273
Cincinnati Machinery & Supply Co	270, 274
Cullon, Austin P	265
DeWitt Tool Co	265
Dony Machinery Co., D. E	274
Eastern Machinery Co	272
Emerman & Co., Louis E	271
Falk Machinery Co	266-267
Globe Trading Co	265
Hasco Machinery Co	271
Hill-Clarke Machinery Co	269
Hyman & Son, Joseph	270
Indianapolis Machinery & Supply Co	272
Lang Co.	274
Lucas & Son Inc., J. L	274
Marsh Mchy. Co	274
Miles Machinery Co	270
Morey Machinery Co., Inc	272
National Machinery Exchange	273
Osborne & Sexton Machinery Co	274
Ott Machinery Sales, Inc	273
Paul's Motor & Mchy. Supply	274
Rodale Mfg. Co. Inc	265
Rosenkranz Machinery Co	274
Saylor & Son, Frank D	265
Simmons Machine Tool Corp	268
S & S Machinery Co	274
Standard Machinery & Supply Co	273
Strong Carlisle & Hammond Co	274
Toomey Machinery Co., Frank	273
West Penn Machinery Co	270
Wigglesworth Machinery Co	273
Zeeve & Co., Alex	270

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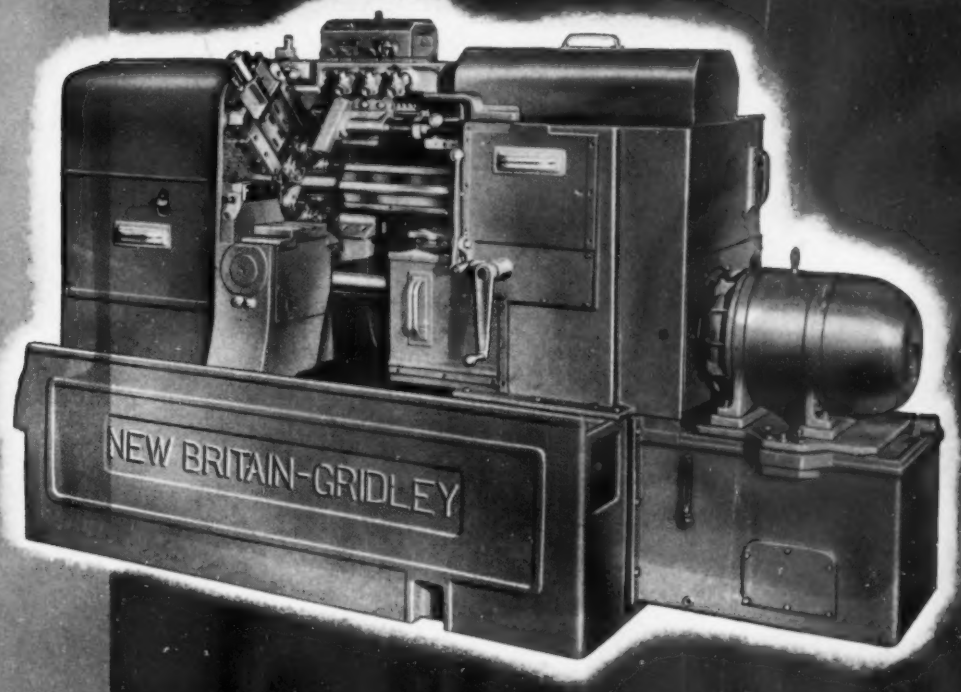

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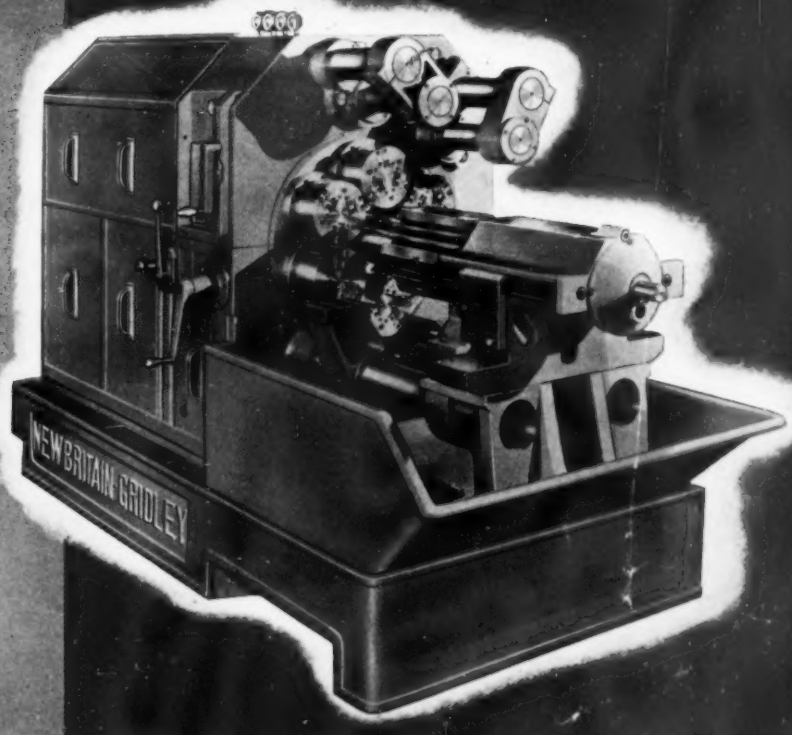

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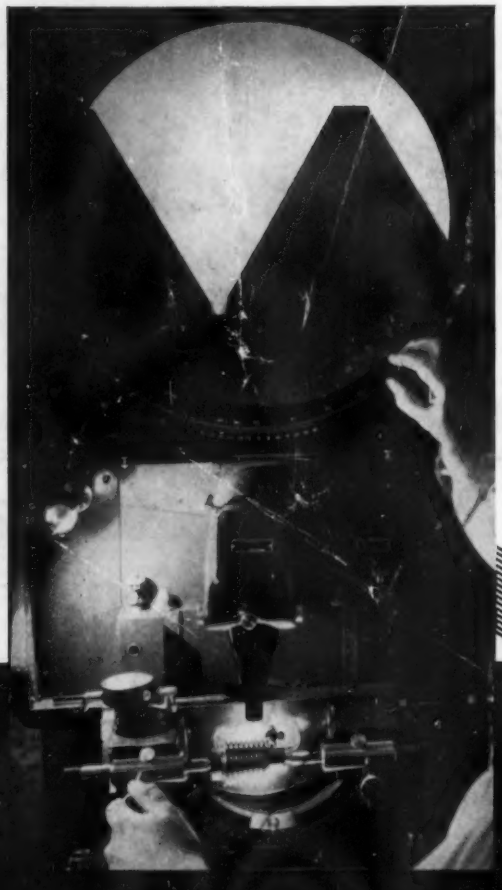
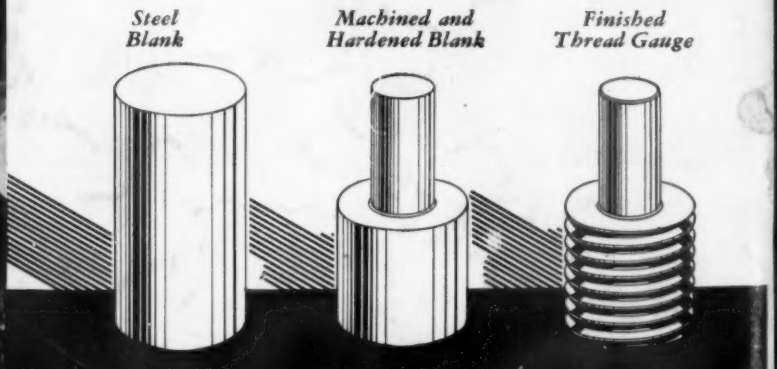
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